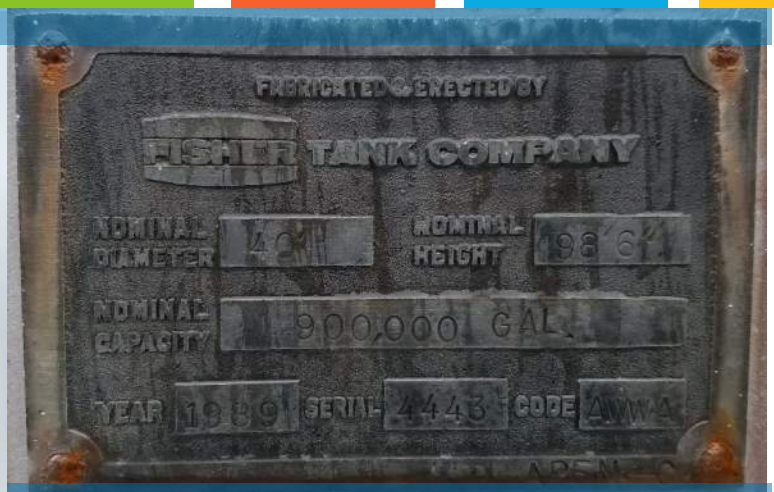

Red Hook Water Storage Tank Engineering Report

Town of Red Hook Water District No. 1

August 24, 2022

STATE OF NEW YORK
DANIEL F. VALENTINE
98426
LICENSED PROFESSIONAL ENGINEER
09/08/2022

Tighe&Bond

Services provided in New York by
T&B Engineering and Landscape Architecture, P.C.

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Tables

Figures

Appendices

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Executive Summary

The Town of Red Hook Water District No. 1 (District) engaged T&B Engineering and Landscape Architecture, P.C. (Tighe & Bond) to evaluate the District's existing water storage tank off of Kelly Road and perform an engineering analysis to assess various alternatives to address the existing tank's current condition. The existing water storage tank was constructed in 1989, has undergone some minor maintenance since its original construction. The tank has not been repainted since its original construction, with the exception for a limited lower portion of the tank's exterior. This report identifies the current condition, deficiencies of the existing tank, and evaluates alternatives to rehabilitate or replace the existing tank and presents opinions of probable construction cost for each alternative.

Need for the Project

The condition and operations of the existing tank needs to be addressed to ensure resilient operations for the District customers and to effectively serve as emergency water supply available for the two other public water systems interconnected to the District system – Bard College and Village of Red Hook.

Need to Address Existing Condition and Water Quality

A tank inspection report prepared by Underwater Solutions, Inc., dated March 21, 2022, identified several deficiencies with the existing tank as did a previous inspection report prepared by Pittsburgh Tank & Tower Group, dated July 10, 2017. Previous tank inspection reports are included for reference in Appendix D.

The existing tank has experienced wear and tear on the welded steel coating system, concrete foundation cracking, and deposition of sediment on the tank bottom over the 33 years that the tank has been in service. Additional requirements/recommendations include improvements for tank access, safety, cathodic protection, and water mixing that have changed since the tank's original construction.

The 2022 Tank Inspection Report identified suspended particulate and/or color throughout the water column, mild biofilm on the interior tank walls, temperature variation from the tank top to bottom, and a total chlorine residual of 0 mg/L at the top of the water column in the storage tank. This is a concern for potential microbial growth and other water quality issues in the distribution system. The existing tank single inlet and outlet and lack of mixing could result in a significant water quality issue if left unaddressed.

The following recommendations are made from the tank inspection reports and additional considerations if the tank is rehabilitated to bring it into good condition:

- Interior sand blast to steel and painting
- Exterior power wash, hand tool spot prep, prime, and overcoat painting
- Reseal exterior junction of tank wall and concrete foundation
- Perform minor concrete repairs and resealing of the existing concrete foundation
- Install safety cable on existing ladder and to roof vent
- Replace bolts and gaskets on shell manways
- Install standoffs on tank for highway radio and telemetry antenna cable
- Install mixing system and necessary conductors and conduit to power
- Replace screen on the overflow pipe discharge
- Install cathodic protection system

Need to Address Interconnection Resiliency

The existing water storage tank provides vital emergency water supply for the Bard College and Village of Red Hook water systems. Improvements to Red Hook Water District No. 1's water storage are needed to provide a resilient emergency.

The Town of Red Hook, Bard College, and the Village of Red Hook share water supply system interconnections and are currently engaged in a Drinking Water Source Protection Program planning effort currently being led by the New York State Department of Health and the NYSDEC. This planning effort has identified the need for the three entities to evaluate their individual source capacity and develop strategies for improving interconnectivity to increase system resilience and reliability. Improved water storage by the Town of Red Hook supports the water system objectives for resilience and reliability to the benefit not only of District users, but also Village residents and water users at Bard College. In addition, both the Bard College and the Village water systems serve Potential Environmental Justice populations.

Existing Storage Tank Facilities

The District has a water storage tank off Kelly Road and Twin Towers Drive that provides storage and pressure to the distribution system, as shown on Figure 1-4. The water storage tank is a welded steel standpipe with a nominal diameter of 40 feet, height of 98.5 feet, and capacity of 900,000 gallons. Standpipes are tall storage tanks primarily used to maintain pressure within a distribution system. In a standpipe, water is held from the ground elevation to the overflow elevation, and standpipes typically have a height to diameter ratio that is greater than 1.0.

The tank overflow elevation, from record drawings, is 386.0, approximately 98.0 feet above the tank bottom elevation. The tank was constructed by the Fisher Tank Company in 1989. According to the *Water Storage Facilities Study* the top 26 feet of the standpipe is capable of storing approximately 250,000 gallons and required to maintain a minimum normal system pressure of 30 psi to all services. The remaining 72.5 feet of standpipe are available for emergency storage. However, only 40 additional feet are available to provide a minimum of 20 psi to the highest part of the water system in the Colonial Drive area. The remaining, bottom 32.5 feet of the tank, below elevation 320.0, are not available for fire flow supply to the highest elevations of the service area."

Storage Capacity Analysis

A storage cap.acity analysis was performed for two demand scenarios with or without provisions for emergency supply for Bard College and the Village of Red Hook water system. Demand data was utilized from 2017 through 2021 to reflect current system operations, historical data from November 2010 when Bard was completely supplied by the District system and projects for future water consumption growth. The two scenarios are as follows:

1. *Projected Water Demand with Red Hook Water District Only*: Average Day Demand from 2017 through 2021 plus 7.6% projected growth. Max Day Demand from 2017 through 2021 plus 7.6% growth.

2. *Projected Water Demand with Emergency Supply to Bard College and Village:* Average Day Demand from November 2010 and Village System 2017 through 2021 plus 7.6% growth. Max Day Demand from 2017 through 2021 from Town District and 2017 through 2021 for Village plus 7.6% growth.

Based on projected future water system demand data, Scenario 1, the recommended minimum useable water storage tank volume is 150,000 gallons. The recommended maximum useable water storage tank volume is 364,000 gallons.

Based on projected future water system demand data with Bard and the Village of Red Hook being served at the same time through their emergency interconnections, Scenario 2, the recommended minimum useable water storage tank volume is 600,000 gallons. The recommended maximum useable water storage tank volume is 1,218,000 gallons.

Tank Turnover Analysis

Water storage tank turnover time is the average time a tank requires to exchange the water in the tank into the distribution system. Tank turnover is important to reduce the risk of chlorine residual loss, development of disinfection byproducts, and other associated water quality issues. Generally, a tank turnover time of 3-5 days is considered favorable.

The tank turnover analysis shows that the existing 900,000-gallon storage tank has a tank turnover time between 14.2 days under current demand and 13.5 days under future demand with just the District system served. A 400,000-gallon storage tank is slightly higher than preferred but with a mixing system could be acceptable. A 300,000-gallon storage tank was analyzed to show what size tank would be necessary to bring the turnover time below 5 days. It is also important to note that this calculation assumes 100% mixing of the water stored. If the tank is not mixed, the tank turnover time for portions of water stored will be higher than those calculated.

This analysis also shows that regardless of the tank size the existing wellfield pumping capacity would need to be increased to support more than a couple days of emergency operation for the projected full demand of both the Village and Bard College systems simultaneously. However, a 900,000-gallon tank could provide an emergency buffer for the interconnected systems or could supplement reduced water production from the interconnected systems.

Siting a New Tank

The District is considering replacing the existing tank. If siting a new tank, the most preferable option is to locate the tank on existing town-owned property. Given the constraints of the parcel discussed in Section 1.2.3, two potential locations were reviewed.

The preferred location is to the southwest of the existing water tower. This location, which is shown on Figure 1-8, is preferred since it is already cleared, requires minimal extension of existing utilities and will relocate the water tower further away from the mono-pole increasing the tanks resiliency. Figure 1-9 shows in more detail the necessary site and piping modifications to locate a new storage tank at the existing site.

Alternatives Analysis

Municipal water storage tanks are typically constructed of steel, glass-fused-to-steel or concrete. Due to the necessary height and configuration of a new tank suited to meet the District's water distribution system needs, a concrete tank was not considered economically feasible. Three alterative options were evaluated:

1. Rehabilitate Existing Welded Steel Standpipe
2. Construct New Glass-Fused-to-Steel Standpipe
3. Construct New Glass-Fused-to-Steel Composite Elevated Tank

Rehabilitate Existing Welded Steel Standpipe

Several of the rehabilitation recommendations made by the 2017 and 2022 tank inspection reports should be considered if a major tank rehabilitation project is undertaken to meet the current standards.

Steel tanks are rugged, versatile tanks that have a long service life. Steel tanks are utilized in all climates where watertight, and even vapor tight, storage is needed. The primary disadvantage of steel tanks is the maintenance expense associated with the coating system. Complete recoating of the interior and exterior coatings is usually required approximately every 15 to 20 years. Rehabilitation of the existing tank requires taking the tank offline and using a temporary storage system to supply pressure to the distribution system during construction. During the period the system is on a temporary storage, emergency water supply cannot be provided to Bard College or the Village of Red Hook. Alternative means of fire protection water supply will also be required. The interconnected water systems and the fire department should be notified prior taking the existing tank offline.

The conceptual opinion of probable construction cost (OPCC) is $1,389,000 (excluding engineering, legal, and financing costs) is the lowest initial capital construction cost of the alternatives. Details of the OPCC are presented in Appendix F.

Construct New Glass-Fused-to-Steel Standpipe

Constructing a new glass-fused-to-steel standpipe of equivalent storage to the existing tank has certain advantages and disadvantages. The existing storage tank would remain in service while the new tank is being constructed. This eliminates the need for a temporary water storage, which is a cost savings and allows the District to continue to provide emergency water supply to Bard College and the Village of Red Hook and provide fire protection.

Glass-lined bolted steel tanks have been used in the waterworks industry since the 1970s. This style of tank is used for potable water, wastewater, landfill leachate, and industrial water storage. The original design had a defect that caused glass delamination from the steel plate at the plate edge. This defect has since been corrected with glass coating of the panel edges. However, sealant is still used on all joints within the tank interior. Regular maintenance items include the appurtenances as well as replacing sealant on a 15 to 20-year interval.

The conceptual OPCC is $3,368,000 (excluding engineering, legal, and financing costs) is $1.98 million greater than the initial capital cost of rehabilitating the existing tank. Details of the OPCC are presented in Appendix F.

Construct New Glass-Fused-to-Steel Composite Elevated Tank

Constructing a new glass-fused-to-steel composite elevated tank with less storage than the existing tank has certain advantages and disadvantages. The existing storage tank would remain in service while the new tank is being constructed. This eliminates the need for a temporary water storage solution, which is a cost savings.

Composite elevated tanks consist of a glass-fused-to-steel tank supported on a cast-in-place concrete column. The column is formed and cast in place resulting in a ring. Successive rings are cast in place on top of each other to build the concrete support column for the glass-fused-to-steel tank.

A composite elevated tank would allow the District to reduce the tank size, which would alleviate concerns of tank turnover, water age, and stagnation. This alternative will also not require temporary storage and will allow continue service to Bard College and the Village of Red Hook and fire protection while the new tank is constructed. However, this alternative would not provide adequate volume of storage to act as an extended duration emergency water supply for the Village of Red Hook.

The conceptual OPCC is $4,063,000 (excluding engineering, legal, and financing costs) is $2.67 million greater than the initial capital cost of rehabilitating the existing tank. Details of the OPCC are presented in Appendix F.

Summary and Comparison of Alternatives

Lifecycle Cost Analyses (LCA) were prepared for each alternative and compared to determine the present worth of the capital and maintenance costs of each alternative. The LCA considered the capital cost of rehabilitation or new construction and any anticipated re-occurring maintenance costs over a 45-year period. Maintenance activities considered for the existing welded steel standpipe are interior and exterior re-coating of the tank every 15 years; for the glass-fused-to-steel tanks maintenance activities considered are re-sealing of panel connections, approximately 25 percent of seals to be re-sealed every 15 years. Both costs include temporary storage needed to enable this repainting or resealing. Other likely re-occurring costs such as replacing mixers, cathodic protection, instrumentation, and ancillary improvements were not included as they would likely be required at approximately the same cost and frequency regardless of the alternative.

An LCA was also prepared for the two new tank construction alternatives (standpipe and CET) assuming a Water Infrastructure Improvement Act (WIIA) grant of 60% of capital cost was awarded to the project. Typically tank repainting projects alone are not successful for grant funding, so no similar LCA was prepared for the rehabilitation alternative. The comparison is presented in Figure 3-1.

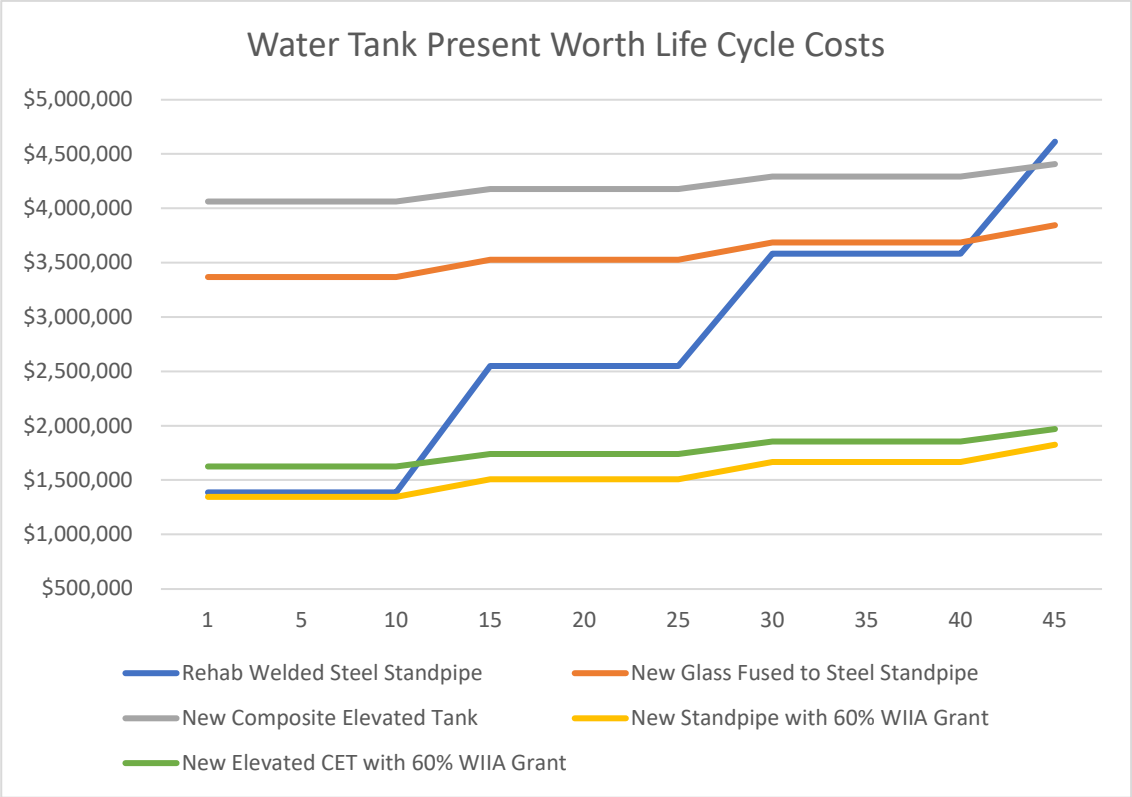

FIGURE 3-1

Water Storage Alternatives Tank Present Worth Life Cycle Costs

Based on the assumptions made for future maintenance and rehabilitation of the existing and proposed tank alternatives evaluated, the life cycle costs analysis indicates that rehabilitation the existing tank in year 1 and every 15 years thereafter will be less costly than construction a new glass-fused-to-steel standpipe or CET for the next 40 to 45 years. In addition, the initial construction cost for rehabilitation of the existing tank is significantly less that initial capital cost of either new tank. However, there is a finite lifespan to the existing welded steel tank, and one could only expect to repaint it so many times. Replacement of the tank with a glass-fused-to-steel tank would significantly reduce the future maintenance cost of the tank and extend the total life of the asset.

The comparison also shows that if the District is successful in obtaining grant funding (60%) to replace the tank with a new glass-fused-to-steel standpipe the initial capital cost would be less expensive than rehabilitating the existing tank time and over a 45-year period the present worth cost to the District would be approximately $2.8 million less.

Recommended and Selected Alternative

Based on the life cycle cost analysis performed in Section 3, rehabilitating and maintaining the existing 900,000-gallon welded steel standpipe is anticipated to be less costly for the next 40 to 45 years if no grant funding is available for the capital expense in year 1. However, if a 60% WIIA grant is awarded to offset the initial capital cost of the project, replacement of the existing welded steel tank with a 900,000-gallon glass-fused-to-steel tank would be slightly less costly in year 1 and be approximately $2.8 million less costly to the District at year 45.

Based on the current water demands of the District a smaller volume of water storage at the same overflow elevation would increase turnover of water in the tank; however, this would reduce the water available for the emergency interconnections to Bard College and the Village of Red Hook water systems. Considering the range of appropriate storage tank sizes presented in Section 1.3.1, a 900,000-gallon tank at the current overflow elevation strikes a balance between water turnover and the emergency storage goals of the system. The addition of a tank mixer should address the current water quality concern of disinfection residual loss at the top of the tank.

We recommend that the District pursue grant funding the replace the existing tank with a 900,000-gallon glass-fused-to-steel standpipe on the same site and adjacent to the existing tank.

An engineer's opinion of probable construction cost to implement the recommended tank alternative is summarized in Table 4-1.

TABLE 4-1
Project Budget for New Standpipe

Category	Estimated Costs
1. Construction Costs	
Contract 1: Water Storage Tank	$ 2,806,400
2. Engineering Costs	
Design	$ 200,000
Construction	$ 235,000
3. Other Expenses	
Local Counsel	$ 15,000
Bond Counsel	$ 25,000
SRF Insurance Costs	$ 113,000
4. Equipment	$ -
5. Land Acquisition	$ -
6. Contingencies	$ 562,400
7. Total Project Costs	$ 3,956,800.
8. Less: Other Sources of Funding	$ -
9. Total Financial Assistance Requested	**$ 3,956,800**

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Section 1
Project Background and History

The Town of Red Hook Water District No. 1 (District) engaged T&B Engineering and Landscape Architecture, P.C. (Tighe & Bond) to evaluate the District's existing water storage tank off of Kelly Road and perform an engineering analysis to assess various alternatives to address the existing tank's current condition. The existing water storage tank was constructed in 1989, has undergone some minor maintenance since its original construction. The tank has not been repainted since its original construction, with the exception for a limited lower portion of the tank's exterior. This report identifies the current condition, deficiencies of the existing tank, and evaluates alternatives to rehabilitate or replace the existing tank and presents opinions of probable construction cost for each alternative.

1.1 Site Information

1.1.1 Location

The Town of Red Hook is located in the northwest corner of Dutchess County. The water storage tank located off of Kelly Road on an access drive called Twin Towers Drive. Twin Towers Drive is a gravel roadway with drainage swales on either side and utilities running below grade. Twin Towers Drive falls within a 50-foot-wide ingress-egress easement with both surface and subsurface access for utilities, which include the water main and communication lines from the cellular tower also located on the property adjacent to the water tank.

1.1.2 Geographic Conditions

The site surrounding the water storage tank is composed mainly of Bernardston silt loams. Bernardston silt loam consists of loamy, acid, dense till derived mainly from phyllite, shale, slate and schist. The soil is well drained on till plains, hills, and drumlinoid ridges with slopes ranging from 15 to 25 percent. The depth to bedrock is commonly within 30 inches from the surface and depth to groundwater within two feet from the surface. The rest of the surrounding site is composed of mainly Haven loam and Dutchess-Cardigan complex, undulating, rocky. Haven loam consists of loamy glaciofluvial deposits over sandy and gravelly glaciofluvial deposits. The soil is well drained and on outwash plains with slopes ranging from 0 to 3 percent. The depth to bedrock and groundwater is both commonly more than 6 feet. The Dutchess-Cardigan complex consists of loamy till derived from phyllite, slate, schist, and shale. The soil is well drained and found on ridges and hills with slopes ranging from 1 to 6 percent. The depth to bedrock and groundwater is both commonly more than 6 feet. The National Resources Conservation Service Custom Soil Resource Report for Dutchess County is included in Appendix G.

1.1.3 Surface Water Features, Environmental Resources, Environmental Justice & Floodplain

The site of the water storage tank does not fall within any resource area polygon as shown on the New York State Department of Environmental Conservation (NYSDEC) Environmental Resource Mapper (see Figure 1-1 below). The locations shown in the Environmental Resource Mapper are not precise locations. Rather, they show the generalized areas where NY Natural Heritage has information in its databases regarding

regulated zones. The site within the surrounding area of the water storage tank consists of Significant Natural Communities west of the site, Rare Plants or Animals and State Regulated Freshwater Wetlands east of the site. The precise locations, as well as the species of the plant or animal, are not provided by this tool.

Sawkill Creek and several unnamed tributaries to Sawkill Creek are also shown in Figure 1-1.

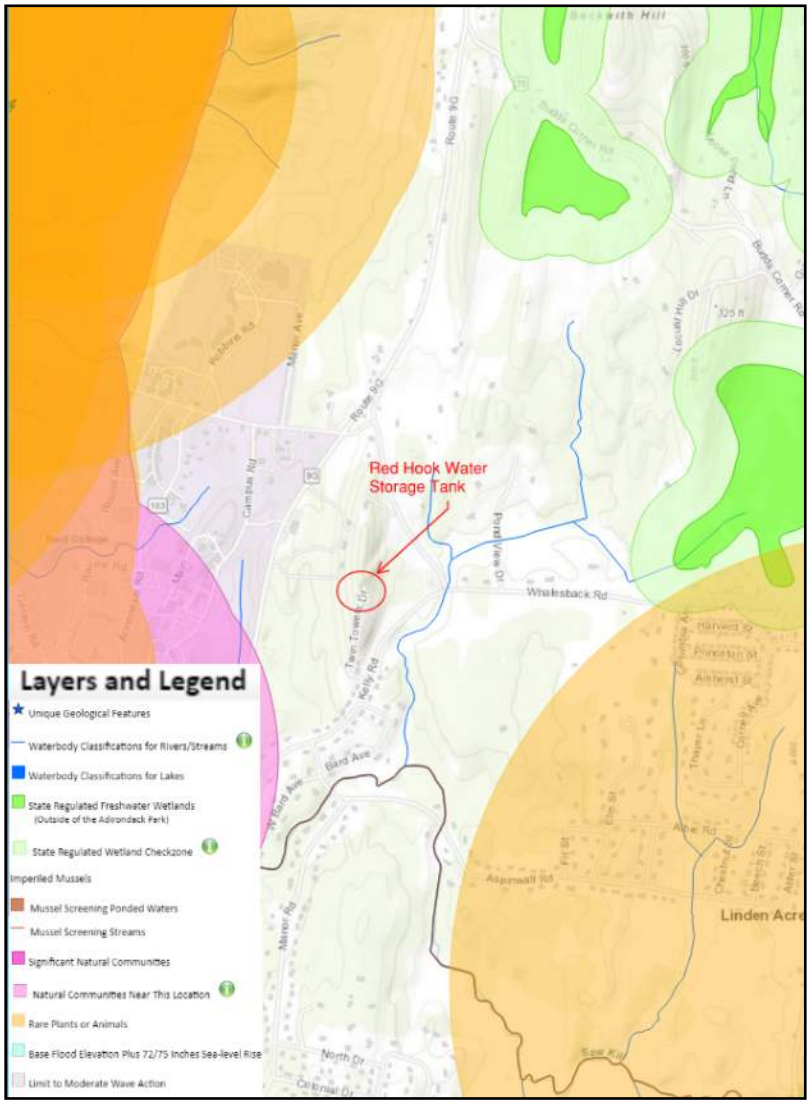

Figure 1-1
NYSDEC Environmental Resources Mapper

According to the NYSDEC, there is a Potential Environmental Justice Area (PEJA) west and southeast of the water storage tank site. These PEJAs include the population served by the Bard College water system and the Village of Red Hook water system. The Red Hook Water District No. 1 storage tank serves as an emergency water supply for both the Bard College Water System and the Village of Red Hook water system. The PEJAs are shown in Figure 1-2.

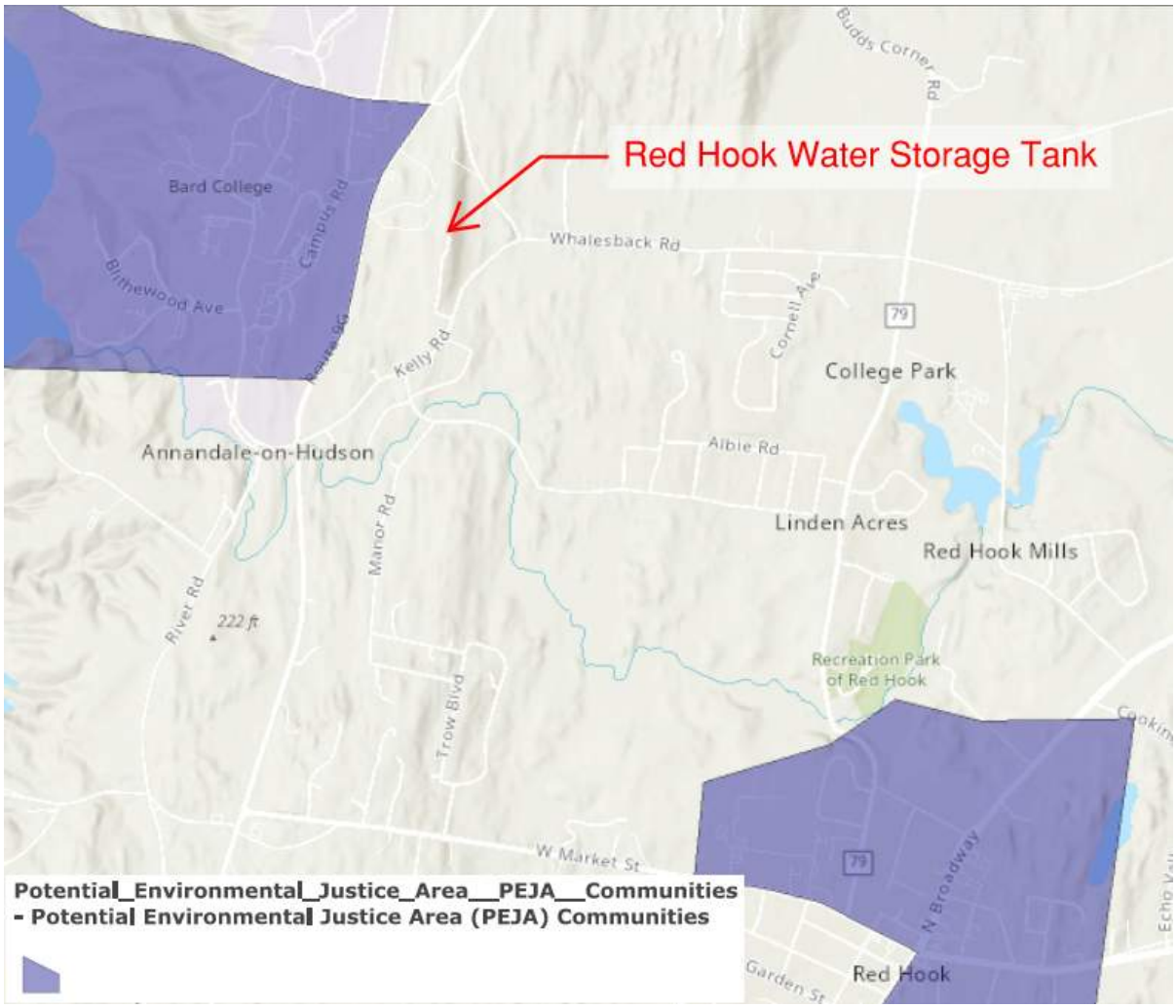

Figure 1-2
Potential Environmental Justice Areas

According to the Federal Emergency Management Agency (FEMA) Flood Map Service Center, no flood hazard is mapped at the site of the water storage tank as shown in Figure 1-3.

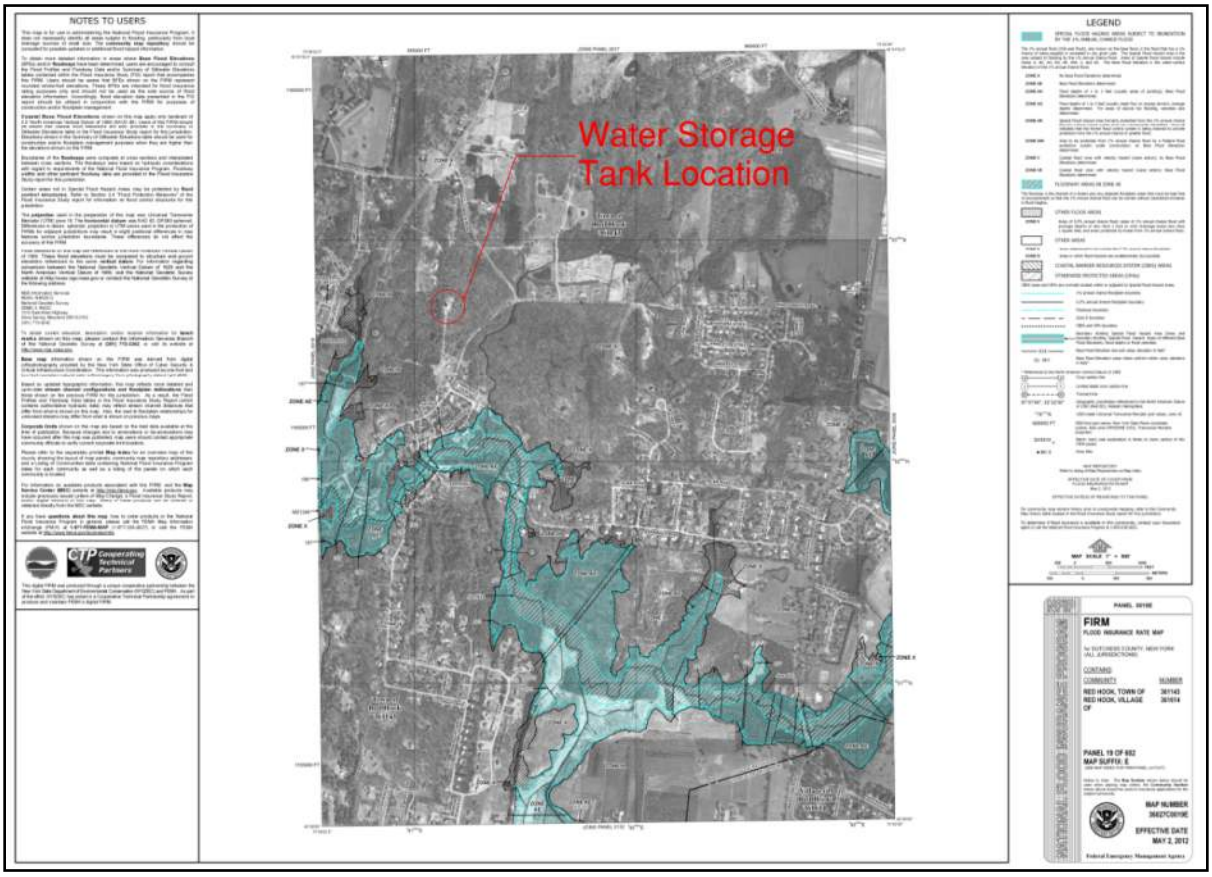

Figure 1-3
FEMA Flood Insurance Map 36027C0019E

1.2 Ownership & Service Area

1.2.1 Water System Description

The Town of Red Hook Water District No. 1 water system serves portions of the Town of Red Hook and is supplied by two wells off Willowbrook Lane. Water is treated and pumped to the existing water storage tank off Twin Tower Road. The water system serves approximately 1,600 people with 488 service connections. The water storage tank is the only source of storage for the water system. The District's water source is a wellfield off Willow Brook Lane, consisting of two wells in an unconsolidated aquifer, each with an original capacity of approximately 250 gallons per minute (gpm). Reportedly, there have not been issues in the past with loss of disinfectant residual, formation of disinfection byproducts, or other water quality issues in the distribution system.

However, the 2022 Tank Inspection Report identified suspended particulate and/or color throughout the water column, a mild biofilm on the interior tank walls, and a total chlorine

residual of 0 mg/L at the top of the water column in the storage tank. For comparison, the total chlorine residual at the bottom of the water column in the storage tank was reported to be 0.4 mg/L.

The water distribution system is shown in Figure 1-4 below.

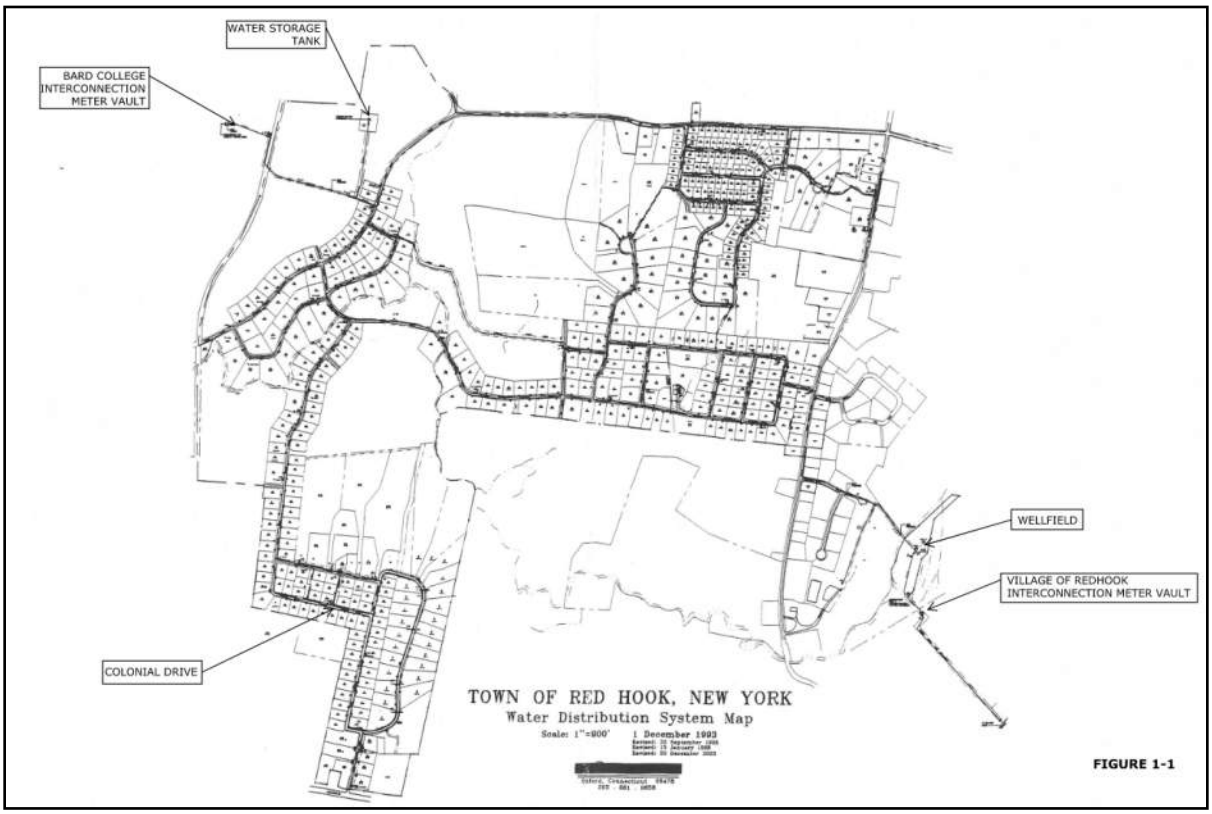

Figure 1-4
Town of Red Hook Water District No. 1 Water Distribution System Map

1.2.2 Outside Users

The District has agreements with Bard College and the Village of Red Hook for emergency water system interconnections. The location of these interconnections is shown on Figure 1-4. When the Bard College water system has needed to be temporarily taken offline for maintenance or capital improvements, the District water system has served as a temporary source of supply through their interconnection. The interconnection for the Village is an emergency interconnection and has historically been used very infrequently. However, the District and the Village water system have recently been in discussions to determine necessary upgrades to this interconnection to improve function in the event of future alternate supply needs.

1.2.3 Water Tank Site Description

The water storage tank is on a parcel owned by the Town of Red Hook. The parcel identification number is 6173-00-802667. An aerial overview of the water storage tank parcel is shown on Figure 1-5 below.

The 2-acre parcel is located within the Residential Development 3 or RD3 zoning district. Per the Town of Red Zoning regulation, the existing parcel does not meet the current requirements as it relates to minimum lot area (3 acres required) and maximum building height (35 feet). The existing parcel however was developed before the existing zoning regulations were in effect and therefore is not required to comply.

Also located on the property is a mono-tower that is owned by the Town and leased to cellphone service providers for the purposes of distributing cell phone service in the area. The mono-tower is located to the north of the water tower and is provided with its own secured gated area separate from the water tower. The mono-tower is located approximately 70’ away from nearest edge of the water tower.

Figure 1-5
Aerial Overview and Parcel Identification of Red Hook Water Storage Tank

1.2.4 Nearby Agricultural Land Use

Sections of Red Hook and nearby areas are part of Agricultural District 20, shown on Figure 1-6 below. The region immediately surrounding the water storage tank contains a number of agricultural farms and stables however not on the storage tank parcel itself. Twin Towers Drive falls within a 50-foot-wide ingress-egress easement with both surface and subsurface access for utilities.

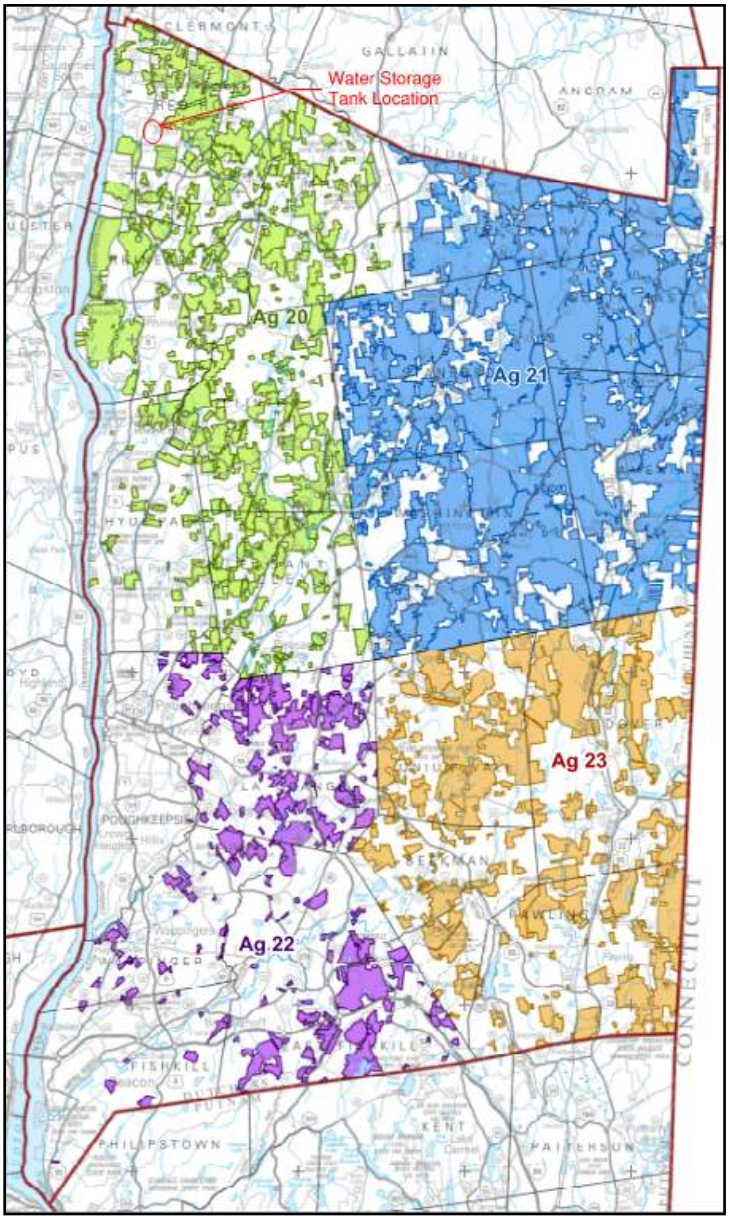

Figure 1-6
Dutchess County Agricultural Districts

1.2.5 Population Trends

The population of the Town of Red Hook is shown in Table 1.1. Between 1990 (nearest date to of tank construction) and 2021 the population of the Town of Red Hook has increased by 4.4%. It should be noted that between the 2010 Census and 2020 Census college students living within a municipality were removed from the count of that municipality. Not counting the Bard students that reside in the Town of Red Hook is the reason for the 12.1% decrease over this time period. It is a statistical nuance and not an actual population reduction.

TABLE 1-1

Town of Red Hook Population 1820 – 2021[1]

Census	Population	% Change	Census	Population	% Change
1820	2,714	---	1930	3,404	5.8%
1830	2,983	9.9%	1940	3,405	0.0%
1840	2,829	-5.2%	1950	4,219	23.9%
1850	3,264	15.4%	1960	6,023	42.8%
1860	3,964	21.4%	1970	7,548	25.3%
1870	4,350	9.7%	1980	8,351	10.6%
1880	4,471	2.8%	1990	9,565	14.5%
1890	4,388	-1.9%	2000	10,408	8.8%
1900	3,895	-11.2%	2010	11,319	8.8%
1910	3,705	-4.9%	2020	9,953	-12.1%
1920	3,218	-13.1%	2021 (estimated)	9,990	0.5%

[1]From U.S. Decennial Census

1.2.6 Historical Water Use Data

Historical water use and production data is provided below in Table 1-2. The maximum daily demand usually coincides with days that the Bard College water system interconnection is active.

TABLE 1-2

2017-2021 Water System Demand (gallons)

Year	Total Year Production	Average Daily Demand	Maximum Daily Demand
2017	31,030,600	85,000	378,500
2018	32,460,200	88,900	398,100
2019	31,849,100	87,200	260,100
2020	31,418,400	86,100	233,700
2021	26,934,700	73,794	252,900

1.3 Existing Storage Tank Facilities

The District has a water storage tank off Kelly Road and Twin Towers Drive that provides storage and pressure to the distribution system, as shown on Figure 1-4. The water storage tank is a welded steel standpipe with a nominal diameter of 40 feet, height of 98.5 feet, and capacity of 900,000 gallons. Standpipes are tall storage tanks primarily used to maintain pressure within a distribution system. In a standpipe, water is held from the ground elevation to the overflow elevation, and standpipes typically have a height to diameter ratio that is greater than 1.0.

The tank overflow elevation, from record drawings, is 386.0, approximately 98.0 feet above the tank bottom elevation. The tank was constructed by the Fisher Tank Company in 1989. According to the *Water Storage Facilities Study* the top 26 feet of the standpipe is capable of storing approximately 250,000 gallons and required to maintain a minimum normal system pressure of 30 psi to all services. The remaining 72.5 feet of standpipe are available for emergency storage. However, only 40 additional feet are available to provide a minimum of 20 psi to the highest part of the water system in the Colonial Drive area. The remaining, bottom 32.5 feet of the tank, below elevation 320.0, are not available for fire flow supply to the highest elevations of the service area." It is important to note that additional distribution system water main improvements were identified in the *Water Storage Facilities Study* to provide the minimum pressures at the above storage tank elevations. The majority of these water main improvements have not been completed since the 1988 study.

Twin Towers Drive falls within a 50-foot-wide ingress-egress easement with both surface and subsurface access for utilities. Based on existing mapping and a field observation, it appears that the utilities running under the access drive include a 12-inch ductile iron pipe, electric service, and fiber optic cable. The gravel roadway ascends a total of 84 feet in elevation change over an approximate distance of 1100 feet for an average slope just over 7.5%.

The existing water tower is in a gated area that is approximately 130' x 90'. The existing fence is in fair condition with some vegetation growing within the chain-link fabric. The topography in the vicinity of the water tower and within the existing fence line is generally gradual in slope. Outside of the existing fence line is mature vegetation and steep slopes located on the east and west side of the water tower. The site is located on a ridgeline that has a flat area at the top of the ridge that travels from south to north. Also located within the water tower fence area, the Town Highway Department has a has a "box" that houses the electronics for a communications antenna that is sited at the top of the water tower.

Figure 1-7 shows an orthographic image of the existing water storage tank site.

WATER STORAGE TANK
RED HOOK, NEW YORK

RED HOOK DISTRICT NO. 1
WATER STORAGE TANK
ORTHOGRAPHIC IMAGERY

DATE:	MAR 2018
SCALE:	1"=100'
FIGURE	1-7

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1.3.1 Storage Capacity Analysis

The 1988 *Water Storage Facilities Study* determined that the water storage tank should be sized to store 250,000 gallons in the top 26 feet of the tank, or at an elevation between 360 feet and 386 feet, to maintain a normal operating pressure of 30 to 40 psi at the apparent high point of the system located at 28 Colonial Drive (approximately 268 ft. NAVD 88). This tank size would satisfy New York State Health Department guidelines, requiring at least an average day demand in storage as well as meets the future fire flow demands and peak hourly conditions in the system (with the well pump running). Extra emergency storage requested by the District is stored below elevation 360 feet for a total storage volume in the standpipe of 900,000 gallons. At the time of the *Water Storage Facilities Study*, District representatives indicated a desire to have at least two days' storage available, which was projected in the future to be 400,000 gallons. To provide at least 20 psi pressure at the system high point during an emergency, the minimum water service elevation would be at elevation 320 feet. Water stored below 320 feet would be considered ineffective or unusable storage for the entire water system.

A summary of water system demands from the 1988 *Water Storage Facilities Study* and recent well production data provided by the District can be found in Table 2-1. We have received well production data from November 2010 and January 2016 through December 2017. We have also received average and maximum day demand data from 2017-2021. During the month of November 2010, Bard College was reportedly performing maintenance on their system and supplying their users entirely with water from the District system. We have included November 2010 data to estimate the water storage capacity required to serve Bard College for an extended period of time. Population projection data from the Cornell Program on Applied Demographics for Dutchess County predict that population will grow on average 7.6% between 2015 and 2040. We have used this projection to increase current water consumption rates to size the tank for future growth in the system.

TABLE 1-3
Water System Demand

1988 *Water Storage Facilities Study*	Gallons Per Day (gpd)
1988 Average Day Demand (ADD)	75,000
1988 Max Day Demand (MDD)	130,000
Projected Future ADD	200,000
Projected Future MDD	400,000
2017-2021 District Well Production Data	
Average Day Demand (ADD)	84,199
Max Day Demand (MDD)	398,100
November 2010 (Bard College Entirely Fed from Red Hook)	
Average Day Demand (ADD)	146,900
Max Day Demand (MDD)	312,800
2017-2021 Village Demand Data	
Average Day Demand (ADD)	244,644
Max Day Demand (MDD)	553,000

Projected District Only (2017-2021 +7.6%)	
Average Day Demand (ADD)	91,000
Max Day Demand (MDD)	428,000
Projected District with Bard & Village Emergency Connections (Nov. 2010 + Village +7.6%)	
Average Day Demand (ADD)	421,000
Max Day Demand (MDD)	1,023,00

Ten States Recommended Standards for Water Works Water indicates that water storage facilities should have sufficient capacity, as determined from engineering studies, to meet domestic demands and where fire protection is provided, fire flow demands. The minimum storage capacity for system not providing fire protection shall be equal to the average daily consumption. This requirement may be reduced when the source and treatment facilities have sufficient capacity with standby power to supplement peak demands of the system. Excessive storage capacity should be avoided to prevent potential water quality deterioration problems. Fire flow requirements established by the appropriate state Insurance Services Office (ISO) should be satisfied where fire protection is provided.

Water storage tanks are generally sized to hold equalization and emergency storage. Equalization storage can be estimated several ways, but in concept is the storage needed to serve the peak hour demand if it exceeds the water supply's pumping capacity (capacity of well pumps.) Emergency storage is the larger of the needed fire flow storage and general emergency storage to supply water during events such as power outages, large water main breaks, or unexpected shutdowns of the water supply facilities or treatment system. General emergency storage can be estimated several ways and is very much dependent on the preference of the water system operator.

A storage capacity analysis was performed for two demand scenarios with or without provisions for emergency supply for Bard College and the Village of Red Hook water system. Demand data was utilized from 2017 through 2021 to reflect current system operations, historical data from November 2010 when Bard was completely supplied by the District system and projects for future water consumption growth. The two scenarios are as follows:

1. *Projected Water Demand with Red Hook Water District Only*: Average Day Demand from 2017 through 2021 plus 7.6% projected growth. Max Day Demand from 2017 through 2021 plus 7.6% growth.

2. *Projected Water Demand with Emergency Supply to Bard College and Village:* Average Day Demand from November 2010 and Village System 2017 through 2021 plus 7.6% growth. Max Day Demand from 2017 through 2021 from Town District and 2017 through 2021 for Village plus 7.6% growth.

Table 2-2 summarizes the two storage tank capacity scenarios evaluated using three methodologies to estimate the equalization storage portion and three methodologies to estimate the emergency storage portion. Minimum and maximum usable water storage volumes were considered to develop a range of acceptable recommended useable

volumes. The maximum needed fire flow was based on the 2002 ISO Hydrant Flow Data Summary Report provided by the District.

TABLE 1-4
Usable Water Storage Volume

Scenario 1: Projected Water Demand with Red Hook Water District Only

	Minimum (gal)	Maximum (gal)
Equalization – 20% - 25% of MDD[1]	86,000	107,000
Equalization – 20% of Tank Volume[2]	30,000	64,000
Equalization – Peak Hour Demand (–) Well Supply Capacity for 6 hours[3]	(-)27,800	6,400
Selected Equalization Storage Component	30,000	107,000
Fire Flow – 1,000 gpm for 2 hours[4]	120,000	120,000
Emergency – 50% - 60% of MDD[1]	214,000	257,000
Emergency – 1 to 2 times ADD	91,000	182,000
Selected Emergency Storage Component	120,000	257,000
Total Useable Storage Tank Volume	**150,000**	**364,000**

Scenario 2: Projected Water Demand with Emergency Supply to Bard College and Village

	Minimum (gal)	Maximum (gal)
Equalization – 20% - 25% of MDD[1]	205,000	256,000
Equalization – 20% of Tank Volume[2]	30,000	210,000
Equalization – Peak Hour Demand (–) Well Supply Capacity for 6 hours[3]	179,000	337,000
Selected Equalization Storage Component	179,000	337,000
Fire Flow – 1,000 gpm for 2 hours[4]	120,000	120,000
Emergency – 50% - 60% of MDD[1]	512,000	614,000
Emergency – 1 to 2 times ADD	421,000	842,000
Selected Emergency Storage Component	421,000	868,000
Total Useable Storage Tank Volume	**600,000**	**1,218,000**

[1] Water Resource Engineering, 2nd Ed., Prentice-Hall, 2006
[2] If equalization storage volume is 20% of total tank volume as sized for emergency storage volume, then the tank should turn over completely every five days on average
[3] Peak Hour Demand calculated as ADD * 2.5 to 4.0 per guidance in Water Distribution Systems Handbook, McGraw-Hill, 2000; Well Supply Capacity of 235 gpm was used
[4] ISO 2002 ISO Hydrant Flow Data Summary Report

Based on projected future water system demand data, Scenario 1, the recommended minimum useable water storage tank volume is 150,000 gallons. The recommended maximum useable water storage tank volume is 364,000 gallons.

Based on projected future water system demand data with Bard and the Village of Red Hook being served at the same time through their emergency interconnections, Scenario 2, the recommended minimum useable water storage tank volume is 600,000 gallons. The recommended maximum useable water storage tank volume is 1,218,000 gallons.

It is unlikely that both the Village of Red Hook and Bard College would have a water emergency at the same time requiring them to both take supply from the District system interconnections. In addition, the Village of Red Hook system requires booster pumping to provide their system with adequate pressure from the District water system. Therefore, water storge in the tank below elevation 360 feet could be useable to the Village water system with a booster pumping station at the interconnection point.

Both Scenario 1 and 2 take in to account a future 7.6% increase in consumption in the water service area. However, the District has indicated there is limited potential for vacant parcels in the water service area to be developed and new services added. Between 1988 and 2017 the average daily demand has only increased by 8,400 gallons per day or roughly 11%, and, in general, water consumption rates per person have reduced in the past decade. According to the Water Research Foundation's 2016 *Residential End Uses of Water, Version 2,* per capita daily indoor water use has decreased 15% between 1999 and 2016, due primarily to improved water efficiently of clothes washer and toilets. If the water service area remains the same, we would not expect an increase in consumption of 11% over the next 30 years and 7.6% appears to be a reasonably conservative rate of water consumption growth.

1.3.2 Tank Turnover Analysis

Water storage tank turnover time is the average time a tank requires to exchange the water in the tank into the distribution system. Tank turnover is important to reduce the risk of chlorine residual loss, development of disinfection byproducts, and other associated water quality issues. Generally, a tank turnover time of 3-5 days is recommended; however, a specific turnover rate should be established on the stored water quality.

The wellfield pumping rate of 235 gpm was used for the tank fill rate and the average daily demand minus the fill rate was used for the tank draw rate. The tank turnover analysis was conducted for various scenarios and tank sizes. A summary of the analysis can be found in Table 2-3.

TABLE 1-5
Tank Turnover Analysis

	Tank Turnover Time (Days)		
ADD Scenario	**900,000 gal Tank**	**400,000 gal Tank**	**300,000 gal Tank**
Current ADD	14.2	6.3	4.7
Scenario 1: Projected ADD with Red Hook Water District Only	13.5	6.0	4.5
Scenario 2: Projected ADD Emergency Supply to Bard College and Village	-8.8[1]	-3.9[1]	-2.9[1]

[1] Projected Average Day Demand in Scenario 2 equals 421,000 gpd or 293 gpm, which exceeds the wellfield pump fill rate of 235 gpm, resulting in a negative tank turnover time

The tank turnover analysis shows that a 900,000-gallon storage tank has a tank turnover time higher than the preferred range of 3-5 days. A 400,000-gallon storage tank is slightly higher than preferred range. A 300,000-gallon storage tank was analyzed to show what size tank would be necessary to bring the turnover time below 5 days. It is important to note that for each scenario, the larger the average daily demand the shorter the turnover time. This means that a tank size that may be a little higher than preferred under current demands but could fall under the 5-day goal if future water demand increases. It is also important to note that this calculation assumes 100% mixing of the water stored. If the tank is not mixed, the tank turnover time for portions of water stored will be higher than those calculated.

A negative turnover time for Scenario 2 indicates that regardless of the tank size the existing wellfield pumping capacity would need to be increased to support more than a couple days of emergency operation for the projected full demand of both the Village and Bard College systems simultaneously. However, a 900,000-gallon tank could provide an emergency buffer for the interconnected systems or could supplement reduced water production from the interconnected systems.

1.3.3 Existing Site Considerations for Siting a New Tank

The District is considering replacing the existing tank. If siting a new tank, the most preferable option is to locate the tank on existing town-owned property. Given the constraints of the parcel discussed in Section 1.2.3, two potential locations were reviewed.

The first location reviewed was on the north side of the existing parcel north of the existing mono-pole structure. This area is approximately 10’ higher than that of existing tank base elevation. This area is not yet cleared, and additional infrastructure would need to be placed to use this area including but not limited to extending the water mains, the access drive and electrical service.

The second location, which is the preferred location, is to the southwest of the existing water tower. This location, which is shown on Figure 1-8, is preferred since it is already cleared, requires minimal extension of existing utilities and will relocate the water tower further away from the mono-pole increasing the tanks resiliency. Ideally, the tank should be located a distance equal to full height of the mono-pole away from the structure, however, due to the constraints of the property line and the topography relocation outside of the fall zone of the mono-pole is likely cost prohibitive. At the proposed location approximately 500 CY of material will need to be brought in to provide a level area for vehicular access around the proposed water tank. Figure 1-9 shows in more detail the necessary site and piping modifications to locate a new storage tank at the existing site.

The proposed location of the new tank is within the required setback for an RD3 zoning district. Assuming the height of the tank remains the same, the Town will not be increasing the non-conformance of the site with existing zoning regulations. However, given the nature of this project and the public interest of those being served, it is likely that the project will be immune from zoning regulations via the precedent set by the Matter of County of Monroe v. City of Rochester, which should allow the Town to evaluate the applicability of the zoning regulations to a Town owned project based on the nine factors required. However, the Town’s attorney should confirm the applicability of zoning regulations to the proposed water storage tank construction.

N

RIP RAP DISPERSION AREA

RIP RAP LINED DITCH

EXISTING 40' DIAMETER WATER TOWER

PROPOSED WATER STORAGE TANK

12" PVC DRAIN PIPE

PROPERTY LINE SETBACK

APPROXIMATE TOWN OWNED PROPERTY LINE

EXISTING CELL TOWER

TWIN TOWERS DRIVE

150.00'

35.00'

60.00'

TREE LINE

12" D.I.P WATER MAIN

APPROXIMATE 50' WIDE INGRESS-EGRESS EASEMENT, WITH BOTH SURFACE AND SUBSURFACE ACCESS FOR UTILITIES

10' WIDE GRAVEL ROADWAY

35.00'

APPROXIMATE MONO-TOWER FALL RADIUS

KELLY ROAD

14' SECURITY GATE

NOTES:

1. EXISTING CONDITIONS DIGITIZED FROM SITE PLAN AND ACCESS ROAD PLAN, PREPARED BY STEARNS & WHELER, DATED 1988, AND SUPPLEMENT BY ORTHOGRAPHIC IMAGERY.
2. TOPOGRAPHIC INFORMATION OBTAINED FROM DUTCHESS COUNTY LIDAR DATA AND IS ON THE NAVD 1988 DATUM.

SCALE IN FEET

0 100' 200'

GRAPHIC SCALE

WATER STORAGE TANK
RED HOOK, NEW YORK

RED HOOK DISTRICT NO. 1
WATER STORAGE TANK
OVERALL SITE LAYOUT

DATE: MAR 2018
SCALE: 1"=100'
FIGURE 1-8

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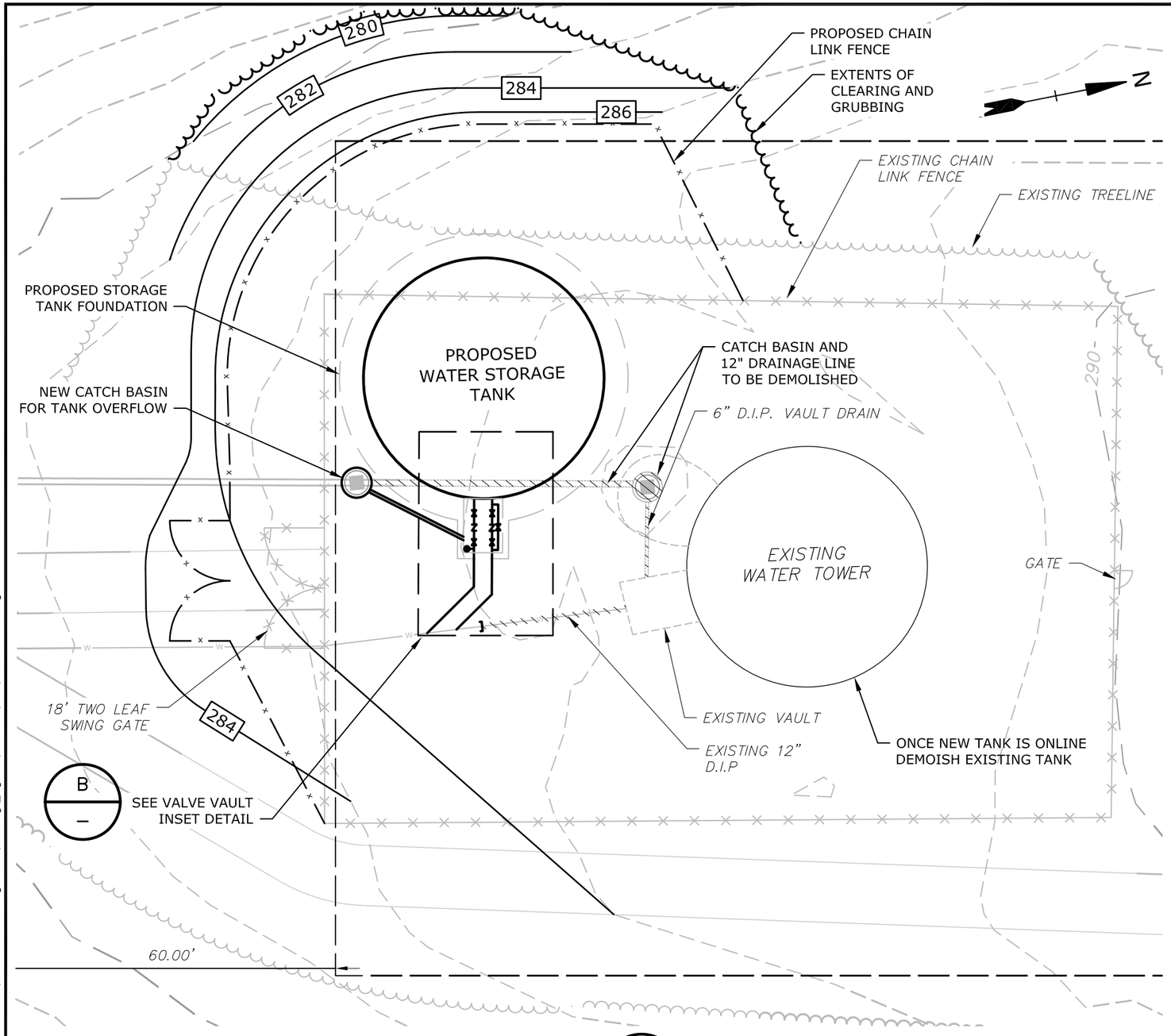
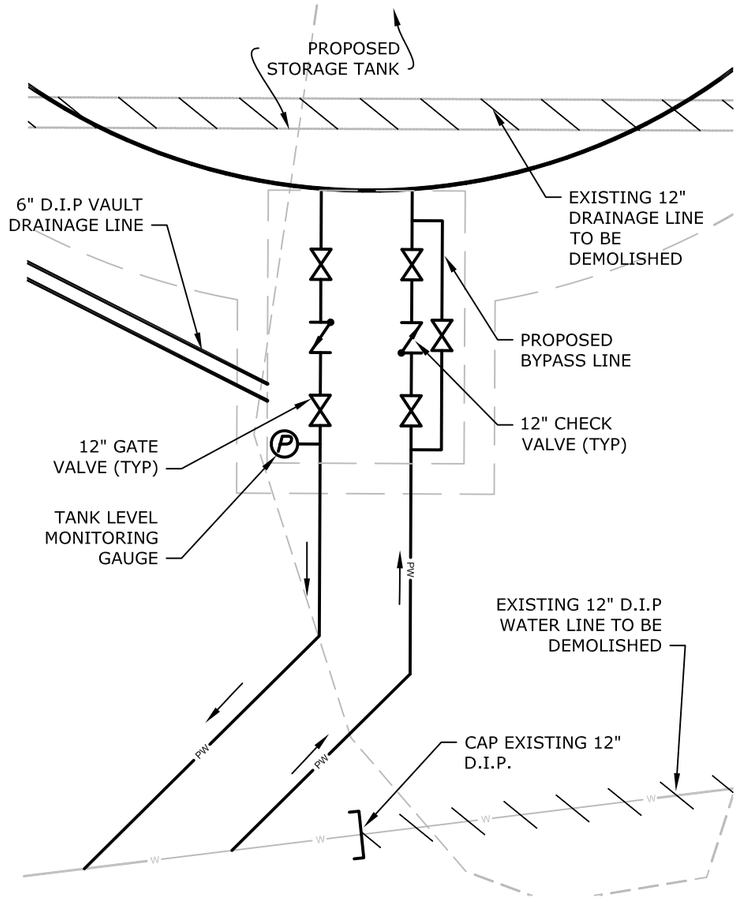
Apr 04, 2018-6:19pm Plotted By: DFV
Tighe & Bond, Inc. J:\R\R5004 Town of Red Hook\004 - Water Storage Tank\Drawings_Figures\AutoCAD\XrefR5004-04 SP.dwg



SITE LAYOUT A
1"=20'



INSET DETAIL B
1"=5'

NOTES:
1. EXISTING CONDITIONS DIGITIZED FROM SITE PLAN AND ACCESS ROAD PLAN, PREPARED BY STEARNS & WHELER, DATED 1988, AND SUPPLEMENT BY ORTHOGRAPHIC IMAGERY.
2. TOPOGRAPHIC INFORMATION OBTAINED FROM DUTCHESS COUNTY LIDAR DATA AND IS ON THE NAVD 1988 DATUM.

WATER STORAGE TANK
RED HOOK, NEW YORK

RED HOOK DISTRICT NO. 1
WATER STORAGE TANK
SITE LAYOUT

DATE:	MAR 2018
SCALE:	1"=100'
FIGURE	1-9

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1.4 Need for the Project

The condition and operations of the existing tank needs to be addressed to ensure resilient operations for the District customers and to effectively serve as emergency water supply available for the two other public water systems interconnected to the District system – Bard College and Village of Red Hook.

1.4.1 Need to Address Existing Condition and Water Quality

A tank inspection report prepared by Underwater Solutions, Inc., dated March 21, 2022, identified several deficiencies with the existing tank as did a previous inspection report prepared by Pittsburgh Tank & Tower Group, dated July 10, 2017. Previous tank inspection reports are included for reference in Appendix D.

The existing tank has experienced wear and tear on the welded steel coating system, concrete foundation cracking, and deposition of sediment on the tank bottom over the 33 years that the tank has been in service. Additional requirements/recommendations include improvements for tank access, safety, cathodic protection, and water mixing that have changed since the tank's original construction.

The well pumps at the wellfield have historically been operated based on water storage tank level recorded by a pressure transducer on the single inlet/outlet pipe in the below grade vault and communicated to the wellfield via a radio antenna system mounted part way up the tank. The existing radio telemetry system has failed and the District is currently operating from system pressure recorded at the wellfield with a fixed pump rate and pump timer. This system operation protocol has been working since the telemetry failure but is prone to inadvertently overflowing the tank and would be better addressed by installing a new pressure transducer, radio, and antenna mounted on the top of the tank. A new antenna at the top of the tank would provide the most accurate water level in the storage tank to the well pump controller.

The 2022 Tank Inspection Report identified suspended particulate and/or color throughout the water column, mild biofilm on the interior tank walls, temperature variation from the tank top to bottom, and a total chlorine residual of 0 mg/L at the top of the water column in the storage tank. This is a concern for potential microbial growth and other water quality issues in the distribution system. The existing tank single inlet and outlet and lack of mixing could result in a significant water quality issue if left unaddressed.

The following recommendations are made from the tank inspection reports and additional considerations if the tank is rehabilitated to bring it into good condition:

- Interior sand blast to steel and painting
- Exterior power wash, hand tool spot prep, prime, and overcoat painting
- Reseal exterior junction of tank wall and concrete foundation
- Perform minor concrete repairs and resealing of the existing concrete foundation
- Install safety cable on existing ladder and to roof vent
- Replace bolts and gaskets on shell manways
- Install standoffs on tank for highway radio and telemetry antenna cable
- Install mixing system and necessary conductors and conduit to power
- Replace screen on the overflow pipe discharge
- Install cathodic protection system

1.4.2 Need to Address Interconnection Resiliency

The existing water storage tank provides vital emergency water supply for the Bard College and Village of Red Hook water systems. Improvements to Red Hook Water District No. 1's water storage are needed to provide a resilient emergency.

The Town of Red Hook, Bard College, and the Village of Red Hook share water supply system interconnections and are currently engaged in a Drinking Water Source Protection Program planning effort currently being led by the New York State Department of Health and the NYSDEC. This planning effort has identified the need for the three entities to evaluate their individual source capacity and develop strategies for improving interconnectivity to increase system resilience and reliability. Improved water storage by the Town of Red Hook supports the water system objectives for resilience and reliability to the benefit not only of District users, but also Village residents and water users at Bard College. In addition, both the Bard College and the Village water systems serve Potential Environmental Justice populations.

1.5 Capacity Development

The system is managed by the District Water Director and Board, and they have a great deal of experience and diversity of backgrounds to meet managerial and financial needs of the water system. The District contracts with C3ND Environmental Consultants, LLC for technical and operational capabilities. The Capacity Development Program Form can be found in Appendix H.

Section 2
Alternatives Analysis

Municipal water storage tanks are typically constructed of steel, glass-fused-to-steel or concrete. Due to the necessary height and configuration of a new tank suited to meet the District's water distribution system needs, a concrete tank was not considered economically feasible. Three alterative options were evaluated:

1. Rehabilitate Existing Welded Steel Standpipe
2. Construct New Glass-Fused-to-Steel Standpipe
3. Construct New Glass-Fused-to-Steel Composite Elevated Tank

2.1 Rehabilitate Existing Welded Steel Standpipe

Several of the rehabilitation recommendations made by previous tank inspections should be considered if a major tank rehabilitation project is undertaken to meet the current standards. When deciding to rehabilitate an existing welded steel tank it is important to understand the advantages and disadvantages of this tank style to assess the reoccurring maintenance requirements.

2.1.1 Welded Steel Tank Considerations

Welded steel tanks are designed from specific parameters for each individual site concerning dead, seismic, and wind loads. Panels are manufactured offsite, shop primed, and welded together on site to form the watertight tank. After welding, blasting, and cleaning, the interiors and exteriors of the tanks are coated with an ANSI/NSF 61 approved paint. Steel tanks can last a long time provided that the coating system is sound, to prevent the underlying steel from corroding.

Steel tanks have been designed and constructed in the United States for over a century. The majority of these tanks are under 5 MG with a considerable number between 5 and 10 MG. There are steel tanks still in service that have been in service for than 100 years. The majority of tanks have performed well, without any noted leakage, if the surface coating is maintained. Welded steel tanks are made of steel plates that are comprised of welded wall sections, floor segments, and roof segments. The roof segments are commonly supported on rafters, beams, and girders, which are then column supported depending on the tank dimensions. The larger the diameter, the more roof framing and column members needed, which adds to the initial and future coating surface areas. Typical concerns with steel tanks include the overall quality control of painting the tank in the field. A significant feature of steel tanks is the thin shell base plates, which offer structural flexibility compared to a concrete base slab. Should column settlement be uneven, steel tank bases are less prone to leakage. Concrete base slabs must be carefully jointed and reinforced to approach the flexibility of steel plate bases. However, steel tanks cannot be buried or be in contact with soil.

To maximize the benefit of a coating system, the experience of the painting contractor and paint inspector is critical. Proper preparation, base coat and topcoat application, and testing of the coating system is required to achieve a coat with minimal holidays, which are pinholes in the coating system. Furthermore, it is important to stripe coat seams and welds, as this is a location where corrosion typically occurs.

Recently, paint manufacturers were required to remove volatile organic compounds (VOCs) from their paint products. Newer paint systems can include a zinc-based primer, which theoretically acts as a sacrificial anode to prevent steel corrosion. Costs of painting have escalated significantly in recent years due in part to increasingly strict regulations and procedures to control stray particulates during application and protect worker health and the environment.

Advantages

- Structural problems are readily evident by staining and rust, and corrective measures are easy to perform
- Not susceptible to structural vandalism
- Designed and constructed to meet ASME Boiler and Pressure Vessel Code resulting in a watertight structure
- Structurally designed for ice conditions
- Can be custom painted

Disadvantages

- High maintenance cost of repainting, which is required at regular intervals to maintain corrosion protection (typically every 15 to 20 years)
- Cathodic protection may be required
- Ice can damage interior coatings, accelerating internal corrosion
- Cannot be partially buried

Summary

Steel tanks are rugged, versatile tanks that have a long service life. Steel tanks are utilized in all climates where watertight, and even vapor tight, storage is needed. The primary disadvantage of steel tanks is the maintenance expense associated with the coating system. Maintenance may be required every 7 to 10 years. Complete recoating of the interior and exterior coatings is usually required approximately every 15 to 20 years. This is a large expense that tends to make construction of new welded steel tanks cost prohibitive when compared to other alternative style tanks. In addition, rehabilitation of the existing tank requires taking the tank offline and using a temporary storage system to supply pressure to the distribution system during construction.

2.1.2 Temporary Water Storage During Rehabilitation

During rehabilitation of the existing standpipe temporary water storage will be required to maintain service to the distribution system. Portable Water Systems, LLC was contacted for sizing and pricing of a temporary hydro-pneumatic tank. Tank sizing was based on 2016-2017 production data of an Average Day Demand (ADD) of 83,400 gallons and a Max Day Demand (MDD) of 281,500 gallons. A consideration for sizing of the temporary water tank is number of fill cycles per hour. Due to the smaller size of temporary water tanks compared to permanent water storage tanks, temporary water tanks require more frequent pumping/fill cycles. To reduce strain on pumps a larger volume tank is recommended to reduce fill cycles per hour to meet the system demand. Portable Water Systems, LLC has recommended a single 17,000-gallon hydro-pneumatic tank for temporary storage during rehabilitation to meet system usage demands, system pressure, site constraints, and minimize fill cycles.

Alternatively, the larger ADD and MDD observed from Bard College everyday usage (November 2010) were not used to size the temporary storage tank as the larger tank

size required to provide those volumes would be difficult to locate at the tank site and would have increased costs. Due to this, the District will not be able to provide water to Bard College or the Village systems while the temporary water storage is being used. Similarly, to provide sufficient water storage for fire-flow conditions multiple large, temporary storage tanks would be required to provide those water volumes. As such, fire-flow requirements were not used to size the temporary storage and fire-flow will not be available while the temporary water storage is in use. It is assumed that the fire department has the necessary pumper truck and surface water source to fight fires during tank rehabilitation. The fire department should be notified prior taking the existing tank offline.

2.2 Construct New Glass-Fused-to-Steel Standpipe

Constructing a new glass-fused-to-steel standpipe of equivalent storage to the existing tank has certain advantages and disadvantages. The existing storage tank would remain in service while the new tank is being constructed. This eliminates the need for a temporary water storage, which is a cost savings. It is also operationally simpler, as discussed in Section 2.1.2, the District would not need to operate the well pumps more frequently to supply the reduced temporary storage, stop the water supply to the Bard or Village system, and eliminate fire-flow capacity during the construction period. As discussed in Section 1.3.2, a 900,000-gallon tank with current ADD would turnover in 14.2 days, on average; however, this additional storage capacity would be needed to provide a resilient emergency water supply to the other interconnected systems. In addition, the addition of a tank mixer would reduce thermal stratification in the tank, loss of disinfection residual, and formation of biofilm.

2.2.1 Glass-Fused-To-Steel Bolted Tank Considerations

The steel plates for glass-fused tanks are coated with a protective, inert material that inhibits rusting and corrosion of the steel plates. The glass coating is applied as a mineral slurry and then baked in a high temperature kiln. The molten glass reacts with the steel surface to form a system that is chemically and mechanically bonded.

Panels are manufactured and coated in a factory setting, and then delivered to sites to be bolted together. The tanks can be factory-engineered for the customer, and can include site-specific tank designs, options, and accessories.

Modern tanks have coating that extends over the panel edges or have stainless steel panel edges, as panel edges are historically problematic regarding corrosion. Sealant is applied to the interior and exterior of the tank at the overlap seam between panels where they are bolted together, as well as at the bolt holes.

Advantages

- Generally lower capital cost when compared to similar size concrete, and potentially similar capital cost when compared to similar size welded steel tanks.
- Designed to require minimal maintenance, without the need of recoating
- Single panels can be replaced if necessary due to failure or vandalism

- Lightweight aluminum self-supporting geodesic dome roofs do not require internal supports
- Faster construction time due to a top-down method that requires minimal equipment and can be constructed in all types of weather
- If the foundation is designed accordingly, the tank can be expanded up to provide additional future storage

Disadvantages

- Panels are bolted together which significantly increases the potential for leaks
- Structural damage can be caused by ice when water turnover is not adequate or ice prevention systems, such as mixers, are not provided
- Glass coating can be damaged by impact vandalism, which can cause delamination of glass on the tank interior
- Lifespan of glass-fused tanks are not definitive since tanks have only been used in the waterworks industry since the 1970s
- Cathodic protection is required for full warranty
- Cannot be partially buried

Summary

Glass-lined bolted steel tanks have been used in the waterworks industry since the 1970s. This style of tank is used for potable water, wastewater, landfill leachate, and industrial water storage. The original design had a defect that caused glass delamination from the steel plate at the plate edge. This defect has since been corrected with glass coating of the panel edges. However, sealant is still used on all joints within the tank interior.

The glass lining is NSF 61 approved, and in the absence of defects, provides a long-lasting coating. Damage to panels by projectiles can cause delamination of the glass on both the inside and outside surface, damage can be repaired with a field applied sealant. Field repairs however are not as well bonded to the steel as the factory applied glass coating.

Tank appurtenances such as vents, hatches, and manways are constructed of hot-dipped galvanized steel. This is an area where regular maintenance will be required. Regular maintenance items include the appurtenances as well as replacing sealant on a 15 to 20-year interval.

2.3 Construct New Glass-Fused-to-Steel Composite Elevated Tank

Constructing a new glass-fused-to-steel composite elevated tank with less storage than the existing tank has certain advantages and disadvantages. The existing storage tank would remain in service while the new tank is being constructed. This eliminates the need for a temporary water storage solution, which is a cost savings. It is also operationally simpler, as discussed in Section 2.1.2, the District would not need to operate the well pumps more frequently to supply the reduced temporary storage, stop water supply to the Bard or Village system, or eliminate fire-flow capacity during the construction period. The reduced tank size would alleviate concerns of tank turnover, water age, and stagnation. As discussed in Section 1.3.2, a 400,000-gallon tank with current ADD would turnover in 6.3 days, close to the recommended turnover of 3-5 days. While this volume of storage should be adequate for the projected future demands of the District water

system only, it may not provide adequate storage for the emergency interconnections to the Bard College or Village water systems.

2.3.1 Glass-Fused-to-Steel Bolted Composite Elevated Tank Considerations

Composite elevated tanks consist of a glass-fused steel tank supported on a cast-in-place concrete column. The column is formed and cast in place resulting in a ring. Successive rings are cast in place on top of each other to build the concrete support column for the glass-fused-to-steel tank. This type of tank eliminates the steel supporting column, which reduces the amount of steel requiring long term maintenance. The concrete pedestal can be used to provide a storage area for vehicles, equipment, water system supplies but may require periodic maintenance.

Advantages

- Designed to be low maintenance
- Single panels can be replaced if necessary due to failure or vandalism
- Lightweight aluminum geodesic roofs require no center pole support
- Eliminates "dead water" storage and provides reduced tank turnover times

Disadvantages

- Panels are bolted together which significantly increases the potential for leaks
- Structural damage caused by ice when water turnover is not adequate or ice prevention systems, such as mixers, are not provided
- Glass coating may be damaged by impact vandalism, but panels can be replaced or repaired with sealant
- Lifespan of glass-fused tanks are not definitive since tanks have only been utilized since the 1970s
- Cathodic protection required
- Concrete pedestal may require maintenance for cracks from the freeze, thaw cycle
- Does not provide adequate emergency storage for interconnected systems

2.4 Opinions of Probable Construction Cost

2.4.1 Existing Welded Steel 900,000 Gallon Standpipe

The tank inspection reports (Appendix D), prepared by Pittsburg Tank & Tower Group and Underwater Solutions, recommended improvements and rehabilitations to address deterioration of the steel tank and bring the tank into compliance with current codes. Recommendations included:

- Interior sand blast to steel and painting
- Exterior power wash, hand tool spot prep, prime, and overcoat painting
- Reseal exterior junction of tank wall and concrete foundation
- Perform minor concrete repairs and resealing of the existing concrete foundation
- Install safety cable on existing ladder and to roof vent
- Replace bolts and gaskets on shell manways
- Install standoffs on tank for highway radio and telemetry antenna cable
- Install mixing system and necessary conductors and conduit to power
- Replace screen on the overflow pipe discharge
- Install cathodic protection system

All recommendations above are included in opinion of probable construction cost (OPCC). Also included was a temporary water storage tank to provide pressure and storage to the system while the existing tank is drained for work. Design and permitting costs are not included in the OPCC. The Conceptual OPCC is $1,389,000 (excluding engineering, legal, and financing costs) and the details of the OPCC are presented in Appendix F.

2.4.2 Glass-Fused-to-Steel 900,000 Gallon Standpipe

Statewide Aquastore was contacted for budgetary pricing for a new construction 900,000-gallon standpipe storage tank. Additional costs for this option include the demolition of the existing storage tank and site work, which includes the following:

- Site clearing and grading;
- Tank foundation excavation and backfill;
- Concrete valve vault;
- Erosion and sediment control;
- Site drainage;
- Piping to connect the new tank to distribution system;
- Testing and disinfection;
- Site restoration;
- Site electrical service extension;
- Instrumentation and tank level antenna;
- Mixing system.

This option does not require temporary water supply as the existing tank can remain in service during construction. Design and permitting costs are not included in the OPCC. The Conceptual OPCC is $3,368,000 (excluding engineering, legal, and financing costs) and the details of the OPCC are presented in Appendix F.

2.4.3 Glass-Fused-to-Steel 436,200 Gallon Elevated Tank

Statewide Aquastore was contacted for budgetary pricing for a new construction 436,200-gallon composite, elevated tank (CET). This size tank was quoted by Aquastore as a standard size CET that would most closely meet the maximum volume and elevation recommendations established in the in the storage capacity analysis in Section 1.3.1. Additional costs for this option include the demolition of the existing storage tank and site work, which includes the following:

- Site clearing and grading;
- Tank foundation excavation and backfill;
- Concrete valve vault;
- Erosion and sediment control;
- Site drainage;
- Piping to connect the new tank to distribution system;
- Testing and disinfection;
- Site restoration;
- Site electrical service extension
- Instrumentation and tank level antenna;
- Mixing system.

This option does not require temporary water supply as the existing tank can remain in service during construction. The Conceptual OPCC is $4,063,000 (excluding engineering, legal, and financing costs) and details of the OPCC are presented in Appendix F.

The OPCCs included in this section and Appendix F are engineer's Opinion of Probable Construction Cost. Tighe & Bond has no control over the cost or availability of labor, equipment or materials, or over market conditions or the Contractor's method of pricing, and that the estimates of probable construction costs are made on the basis of Tighe & Bond's professional judgment and experience. Tighe & Bond makes no guarantee nor warranty, expressed or implied, that the bids or the negotiated cost of the Work will not vary from this estimate of the Probable Construction Cost.

Section 3
Summary and Comparison of Alternatives

Lifecycle Cost Analyses (LCA) were prepared for each alternative and compared to determine the present worth of the capital and maintenance costs of each alternative. The LCA considered the capital cost of rehabilitation or new construction and any anticipated re-occurring maintenance costs over a 45-year period. Maintenance activities considered for the existing welded steel standpipe are interior and exterior re-coating of the tank every 15 years; for the glass-fused-to-steel tanks maintenance activities considered are re-sealing of panel connections, approximately 25 percent of seals to be re-sealed every 15 years. Both costs include temporary storage needed to enable this repainting or resealing. Other likely re-occurring costs such as replacing mixers, cathodic protection, instrumentation, and ancillary improvements were not included as they would likely be required at approximately the same cost and frequency regardless of the alternative.

A LCA was also prepared for the two new tank construction alternatives (standpipe and CET) assuming a Water Infrastructure Improvement Act (WIIA) grant of 60% of capital cost was awarded to the project. Typically tank repainting projects alone are not successful for grant funding, so no similar LCA was prepared for the rehabilitation alternative. The comparison is presented in Figure 3-1 and Table 3-1 below.

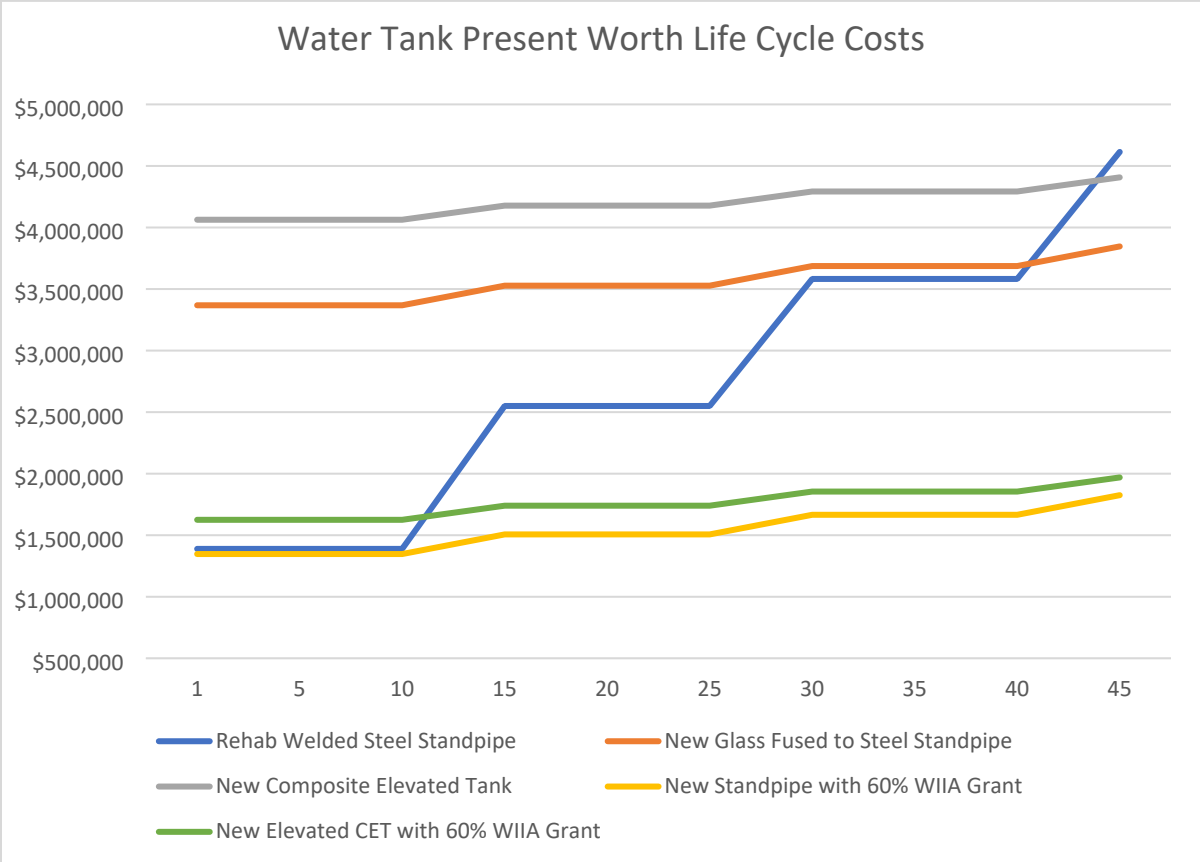


FIGURE 3-1

Water Storage Alternatives Tank Present Worth Life Cycle Costs

Based on the assumptions made for future maintenance and rehabilitation of the existing and proposed tank alternatives evaluated, the life cycle costs analysis indicates that rehabilitation the existing tank in year 1 and every 15 years thereafter will be less costly than construction a new glass-fused-to-steel standpipe or CET for the next 40 to 45 years. In addition, the initial construction cost for rehabilitation of the existing tank is significantly less that initial capital cost of either new tank. However, there is a finite lifespan to the existing welded steel tank, and one could only expect to repaint it so many times. Replacement of the tank with a glass-fused-to-steel tank would significantly reduce the future maintenance cost of the tank and extend the total life of the asset.

The comparison also shows that if the District is successful in obtaining grant funding (60%) to replace the tank with a new glass-fused-to-steel standpipe the initial capital cost would be less expensive than rehabilitating the existing tank time and over a 45-year period the present worth cost to the District would be approximately $2.8 million less.

TABLE 3-1

Tank Alternatives Life Cycle Cost Comparison

↓Costs ($M)\Years→	**1**	**5**	**10**	**15**	**20**	**25**	**30**	**35**	**40**	**45**
Existing Welded Steel Standpipe	$1.389	$1.389	$1.389	$1.389	$1.389	$1.389	$1.389	$1.389	$1.389	$1.389
Re-Coating (15-year cycle)	$0.000	$0.000	$0.000	$1.161	$0.000	$0.000	$1.032	$0.000	$0.000	$1.032
Total	**$1.389**	**$1.389**	**$1.389**	**$2.550**	**$2.550**	**$2.550**	**$3.582**	**$3.582**	**$3.582**	**$4.614**
Glass-Fused-to-Steel Standpipe	$3.368	$3.368	$3.368	$3.368	$3.368	$3.368	$3.368	$3.368	$3.368	$3.368
Re-Sealing (15-year cycle)	$0.000	$0.000	$0.000	$0.159	$0.000	$0.000	$0.159	$0.000	$0.000	$0.159
Total	**$3.368**	**$3.368**	**$3.368**	**$3.527**	**$3.527**	**$3.527**	**$3.687**	**$3.687**	**$3.687**	**$3.846**
Glass-Fused-to-Steel CET	$4.063	$4.063	$4.063	$4.063	$4.063	$4.063	$4.063	$4.063	$4.063	$4.063
Re-Sealing (15-year cycle)	$0.000	$0.000	$0.000	$0.115	$0.000	$0.000	$0.115	$0.000	$0.000	$0.115
Total	**$4.063**	**$4.063**	**$4.063**	**$4.178**	**$4.178**	**$4.178**	**$4.293**	**$4.293**	**$4.293**	**$4.407**
Glass-Fused-to-Steel Standpipe (WIIA)	$1.347	$1.347	$1.347	$1.347	$1.347	$1.347	$1.347	$1.347	$1.347	$1.347
Re-Sealing (15-year cycle)	$0.000	$0.000	$0.000	$0.159	$0.000	$0.000	$0.159	$0.000	$0.000	$0.159
Total	**$1.347**	**$1.347**	**$1.347**	**$1.507**	**$1.507**	**$1.507**	**$1.666**	**$1.666**	**$1.666**	**$1.825**
Glass-Fused-to-Steel CET (WIIA)	$1.625	$1.625	$1.625	$1.625	$1.625	$1.625	$1.625	$1.625	$1.625	$1.625
Re-Sealing (15-year cycle)	$0.000	$0.000	$0.000	$0.115	$0.000	$0.000	$0.115	$0.000	$0.000	$0.115
Total	**$1.625**	**$1.625**	**$1.625**	**$1.740**	**$1.740**	**$1.740**	**$1.855**	**$1.855**	**$1.855**	**$1.969**

Section 4
Recommended and Selected Alternative

Based on the life cycle cost analysis performed in Section 3, rehabilitating and maintaining the existing 900,000-gallon welded steel standpipe is anticipated to be less costly for the next 40 to 45 years if no grant funding is available for the capital expense in year 1. However, if a 60% WIIA grant is awarded to offset the initial capital cost of the project, replacement of the existing welded steel tank with a 900,000-gallon glass-fused-to-steel tank would be slightly less costly in year 1 and be approximately $2.8M less costly to the District at year 45.

Based on the current water demands of the District a smaller volume of water storage at the same overflow elevation would increase turnover of water in the tank; however, this would reduce the water available for the emergency interconnections to Bard College and the Village of Red Hook water systems. Considering the range of appropriate storage tank sizes presented in Section 1.3.1, a 900,000-gallon tank at the current overflow elevation strikes a balance between water turnover and the emergency storage goals of the system. The addition of a tank mixer should address the current water quality concern of disinfection residual loss at the top of the tank.

We recommend that the District pursue grant funding the replace the existing tank with a 900,000-gallon glass-fused-to-steel standpipe on the same site and adjacent to the existing tank.

An engineer's opinion of probable construction cost to implement the recommended tank alternative is summarized in Table 4-1 below.

TABLE 4-1
Project Budget for New Standpipe

Category	**Estimated Costs**
1. Construction Costs	
Contract 1: Water Storage Tank	$ 2,806,400
2. Engineering Costs	
Design	$ 200,000
Construction	$ 235,000
3. Other Expenses	
Local Counsel	$ 15,000
Bond Counsel	$ 25,000
SRF Insurance Costs	$ 113,000
4. Equipment	$ -
5. Land Acquisition	$ -
6. Contingencies	$ 562,400
7. Total Project Costs	$ 3,956,800.
8. Less: Other Sources of Funding	$ -
9. Total Financial Assistance Requested	**$ 3,956,800**

J:\R\R5004 Town of Red Hook\028 - WST Design\Reports\Red Hook WST Preliminary Engineering Report.docx

APPENDIX A

CONTRACT DRAWINGS
900,000 GALLON WATER STORAGE TANK
TOWN OF RED HOOK, NEW YORK
WATER DISTRICT NO. 1
CONTRACT NO. 1
1988

TOWN OF RED HOOK

SUPERVISOR
JOHN GILFEATHER

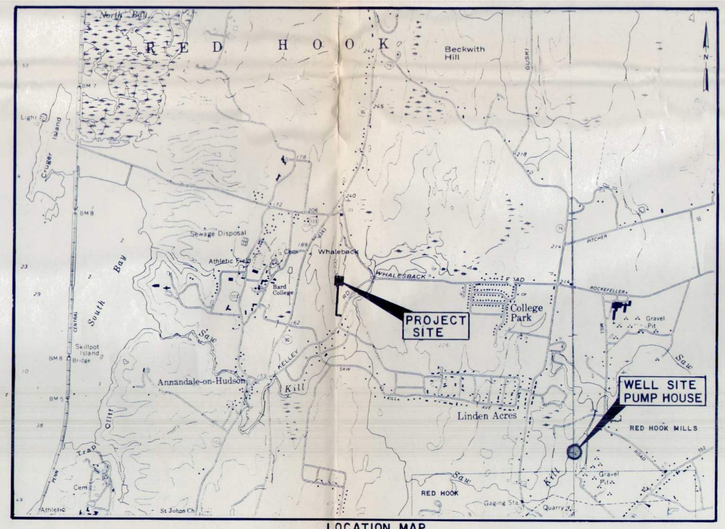
COUNCILMEN
ROBERT GREIG
GEORGE REID
RICHARD J. HOGAN
JOSEPH A. CHERNY JR.

WATER BOARD
RAYMOND RHODES
ROLAND DUPONT
RAYMOND TUTON
THEADORE KUDZY
HENRY VAN PARYS

TOWN CLERK &
TAX COLLECTOR
MARGARET E. DOTY

TOWN ATTORNEY
ALBERT R. TREZZA

WATER SUPERINTENDENT
JIM REILLY



LOCATION MAP
SCALE 1"= 2000'

Stearns & Wheler
ENGINEERS AND SCIENTISTS
CAZENOVIA, NEW YORK DARIEN, CONNECTICUT

STATE OF NEW YORK
THOMAS CARROLL BURKLY
PE 046011
LICENSED PROFESSIONAL ENGINEER

NYPE LICENSE NO. 046011

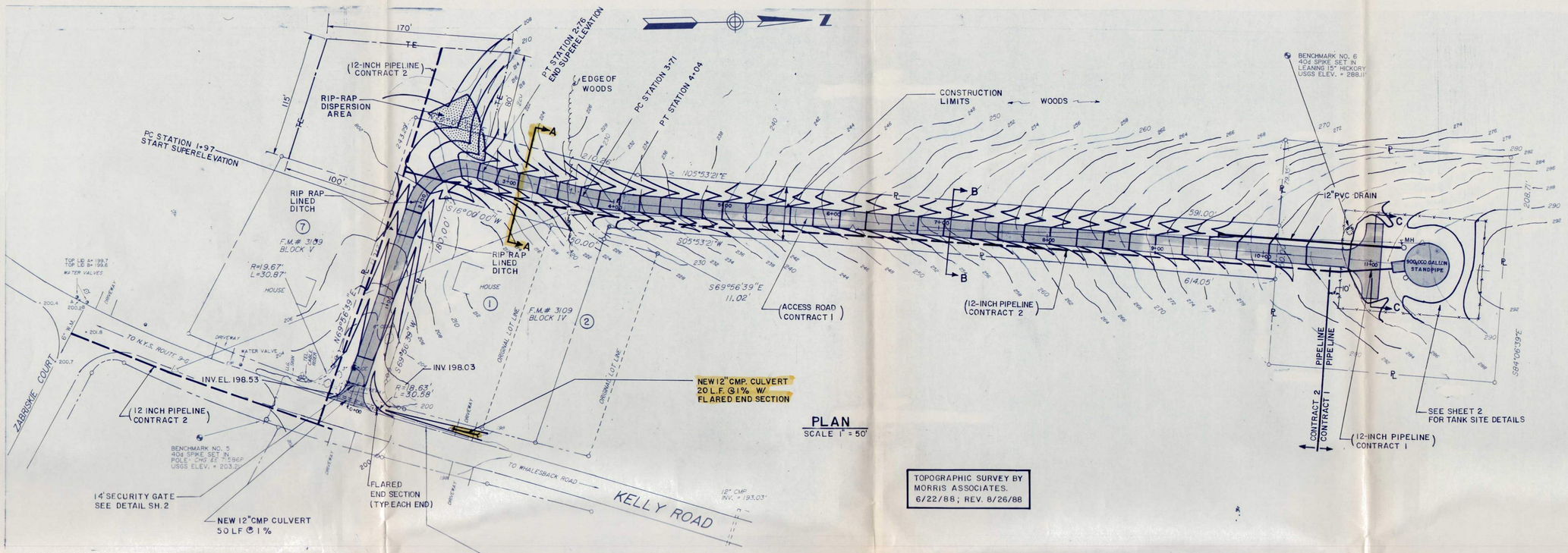
INDEX OF CONTRACT DRAWINGS

NO.	TITLE
1	SITE PLAN AND ACCESS ROAD
2	900,000 GALLON WATER STORAGE TANK SITE PLAN AND ACCESS ROAD
3	900,000 GALLON WATER STORAGE TANK STRUCTURAL PLANS, SECTIONS, & DETAILS
4	MISCELLANEOUS DETAILS

DUTCHESS COUNTY DEPARTMENT OF HEALTH
APPROVED
DATE: 6/6/89
PROJECT: Red Hook Water District #1
Storage Tank
(1) Red Hook
John H. Thorn PE
Senior PUBLIC HEALTH ENGINEER

RECOMMENDED FOR APPROVAL

Received 6/6/89 R K Rhodes, Chmn. Water Board.



PLAN
SCALE 1" = 50'

TOPOGRAPHIC SURVEY BY MORRIS ASSOCIATES. 6/22/88; REV. 8/26/88

NOTE: UNDERGROUND TELEPHONE CABLE (CONTEL) RUNS ALONG NORTHWESTERLY SIDE OF KELLY ROAD APPROXIMATELY 2 TO 3 FT. OFF EDGE OF PAVEMENT.

NOTES:

Underground facilities, structures and utilities have been plotted from available surveys and records, and therefore their locations must be considered approximate only. There may be others, the existence of which is presently not known.

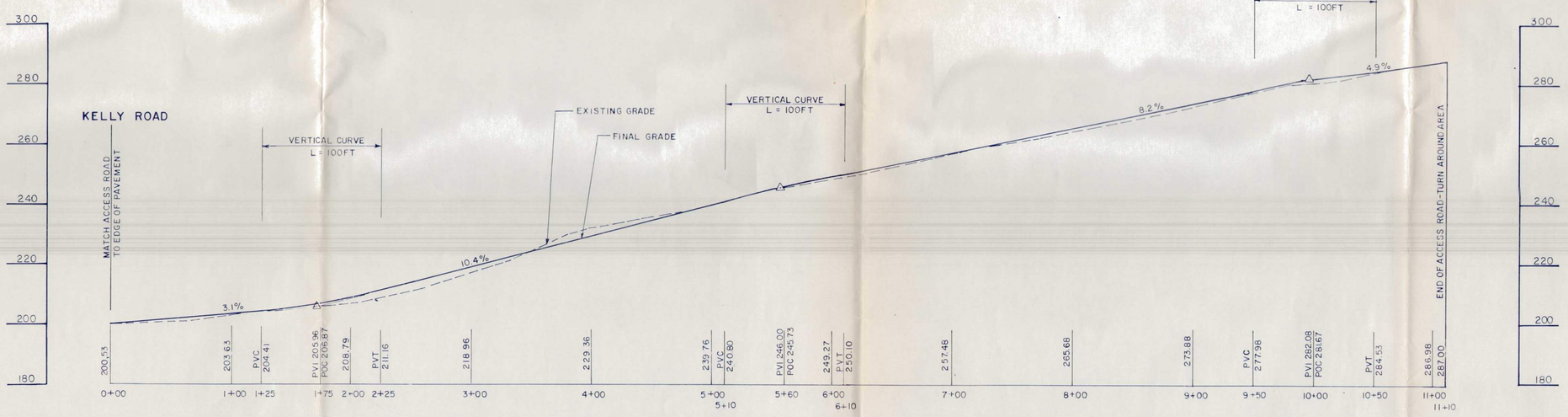
It is a violation of the New York State Education Law for any person, unless he is acting under the direction of a licensed professional engineer, to alter an item on this drawing in any way. If an item is altered, the altering engineer shall affix to the item his seal and the notation "altered by" followed by his signature and the date of such alteration, and a specific description of the alteration.

NOTES:

1. The Contractor shall confine his construction operations within the property lines and temporary easement lines as shown on the Contract Drawings.
2. All elevations refer to USGS datum.
3. Topsoil to be removed from the areas to be excavated or filled shall be stockpiled and then respread to finished grade.
4. Provide silt screens or hay bales as necessary to prevent runoff due to erosion.
5. Contractor shall clear all trees 20 feet of either side of the centerline of the access road and all trees within 10 feet outside the perimeter of the chain link fence. Selective clearing outside these limits shall be as approved by the Engineer or Owner.
6. Access Road curve data to be provided by Engineer at pre construction meeting

LEGEND

- PROPOSED PIPING
- PROPERTY LINE
- TEMPORARY CONSTRUCTION EASEMENT
- FENCE
- EXISTING CONTOURS (272)
- PROPOSED CONTOURS
- BASELINE CONTROL POINT
- MANHOLE (MH)
- CULVERT (12" D)
- WATER VALVE
- POLE
- UNDERGROUND TELEPHONE (T)
- BENCHMARK
- SPOT ELEVATIONS (200.7)
- WOODS
- SERVICE CONNECTION



ACCESS ROAD ℄ PROFILE
SCALE: HORIZ. 1"= 50'
VERT. 1"= 20'

DUTCHESS COUNTY DEPARTMENT OF HEALTH
POUGHKEEPSIE, NEW YORK
These plans are approved
Last sheet for date and signatures.

STATE OF NEW YORK · THOMAS CARROLL BURKLEY · PE 046011 · LICENSED PROFESSIONAL ENGINEER

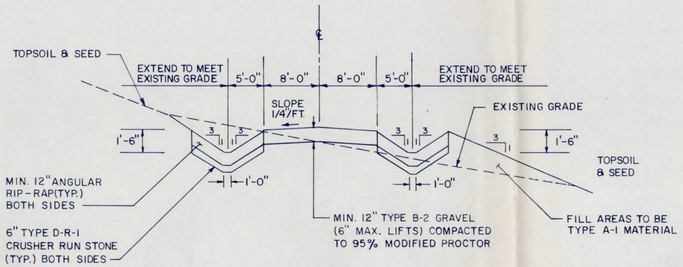
ISSUE NO.		DRAWN	DATE	CHECKED	DESIGNER	APPROVED	DATE
2	FOR CONSTRUCTION	MS	10/88	CWE	CJD	TCB	10/7/88
1	FOR APPROVAL	MS	8/88	CWE	CJD	TCB	9/16/88

PROJECT SUPERVISOR: C. Wichael Elliott — APPROVED: T. Burkley

TOWN OF RED HOOK, NEW YORK
WATERWORKS CONSTRUCTION
900,000 GALLON WATER STORAGE TANK
SITE PLAN AND ACCESS ROAD

Stearns & Wheler
ENGINEERS AND SCIENTISTS
CAZENOVIA, NEW YORK — DARIEN, CONNECTICUT

JOB NO. 1479 | CONTRACT NO. 1 | SHEET 1 OF 4



SECTION A-A

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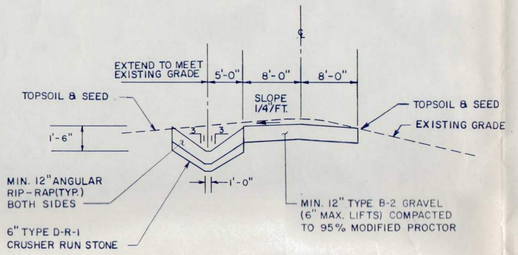
1"= 5' VERT.



SECTION B-B

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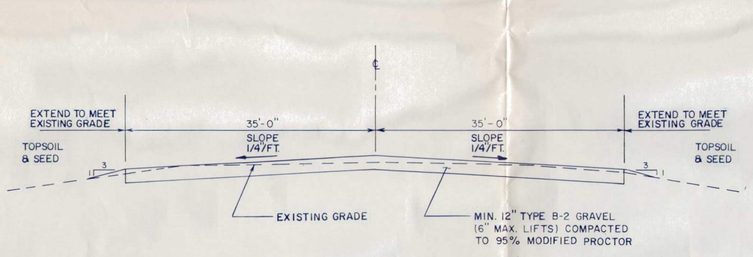
1"= 5' VERT.



SECTION C-C

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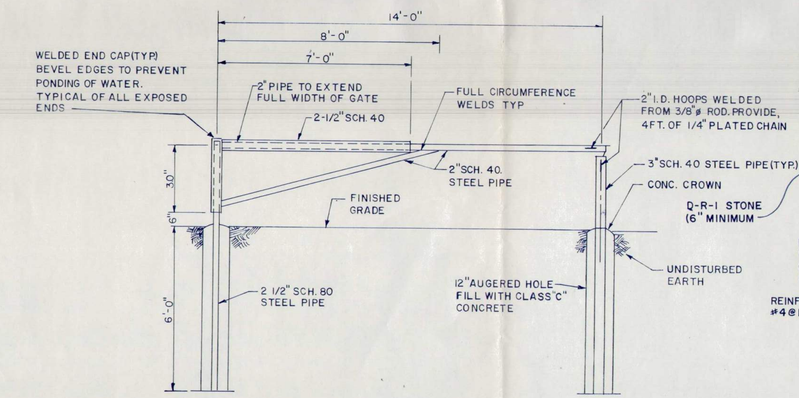
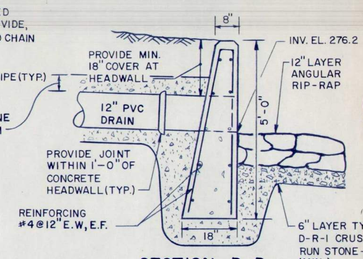
1"= 5' VERT.

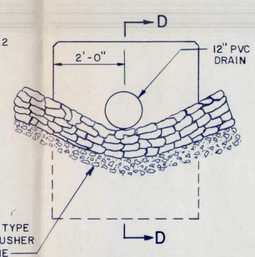


SECURITY GATE DETAIL

NTS



SECTION D-D



CONCRETE HEADWALL

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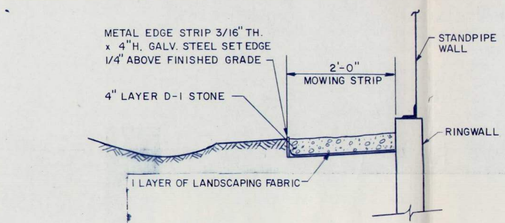
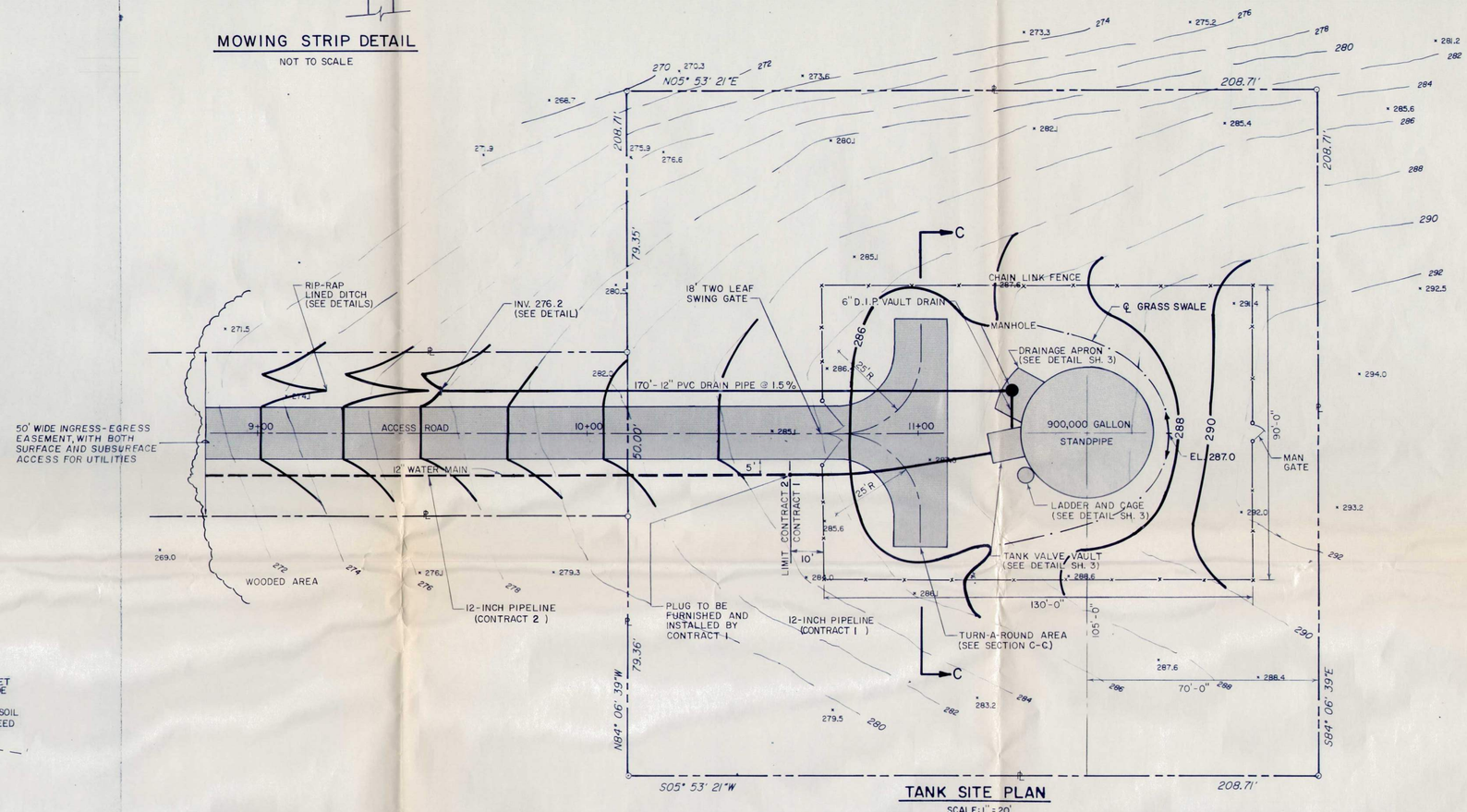


MOWING STRIP DETAIL

NOT TO SCALE



TANK SITE PLAN

SCALE: 1" = 20'

NOTES:

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ABBREVIATIONS

Length	L	Aluminum	AL
Manhole	MH	Benchnmark	BM
Manufacturer	MFR.	Bituminous	BIT
Maximum	Max.	Cast Iron Pipe	CIP
Minimum	Min.	Concrete	CONC.
On Center	O.C.	Connections	CONNS
Point of Curve	PC	Continuous	CONT
Point of Tangent	PT	Contractor	CONTR
Point Vertical Curve	POC	Corrugated Metal Pipe	CMP
Point Vertical Intersection	PVI	Diameter	DIA, ø
Point Vertical Tangent	PVT	Ductile Iron Pipe	DIP
Radius	Rad, R	Each	Ea.
Reinforcing	Reinf.	Each Face	E.F.
Schedule	SCH.	Each Way	E.W.
Square	SQ.	Edge of Pavement	E.P.
Temporary Construction Easement	TE	Elevation	EL.
Telephone	Tel.	Feet	
Top of Slab	T.O.S.	High Point	H.PT.
Typical	Typ.	Inside Diameter	I.D.
Water Main	W.M.	Invert	Inv.
Water Stop	W.S.		

DUTCHESS COUNTY DEPARTMENT OF HEALTH POUGHKEEPSIE, NEW YORK
These plans are approved as noted hereon for date and signatures.

STATE OF NEW YORK THOMAS CARROLL BURKLEY LICENSED PROFESSIONAL ENGINEER PE 046011

ISSUE NO.	DRAWN	DATE	CHECKED	DESIGNER	APPROVED	DATE
2	FOR CONSTRUCTION RC 10/88		CJE	CJD	TCB	11/7/88
1	FOR APPROVAL RC/JY	8/88	CJE	CJD	TCB	9/21/88

PROJECT SUPERVISOR APPROVED

TOWN OF RED HOOK, NEW YORK

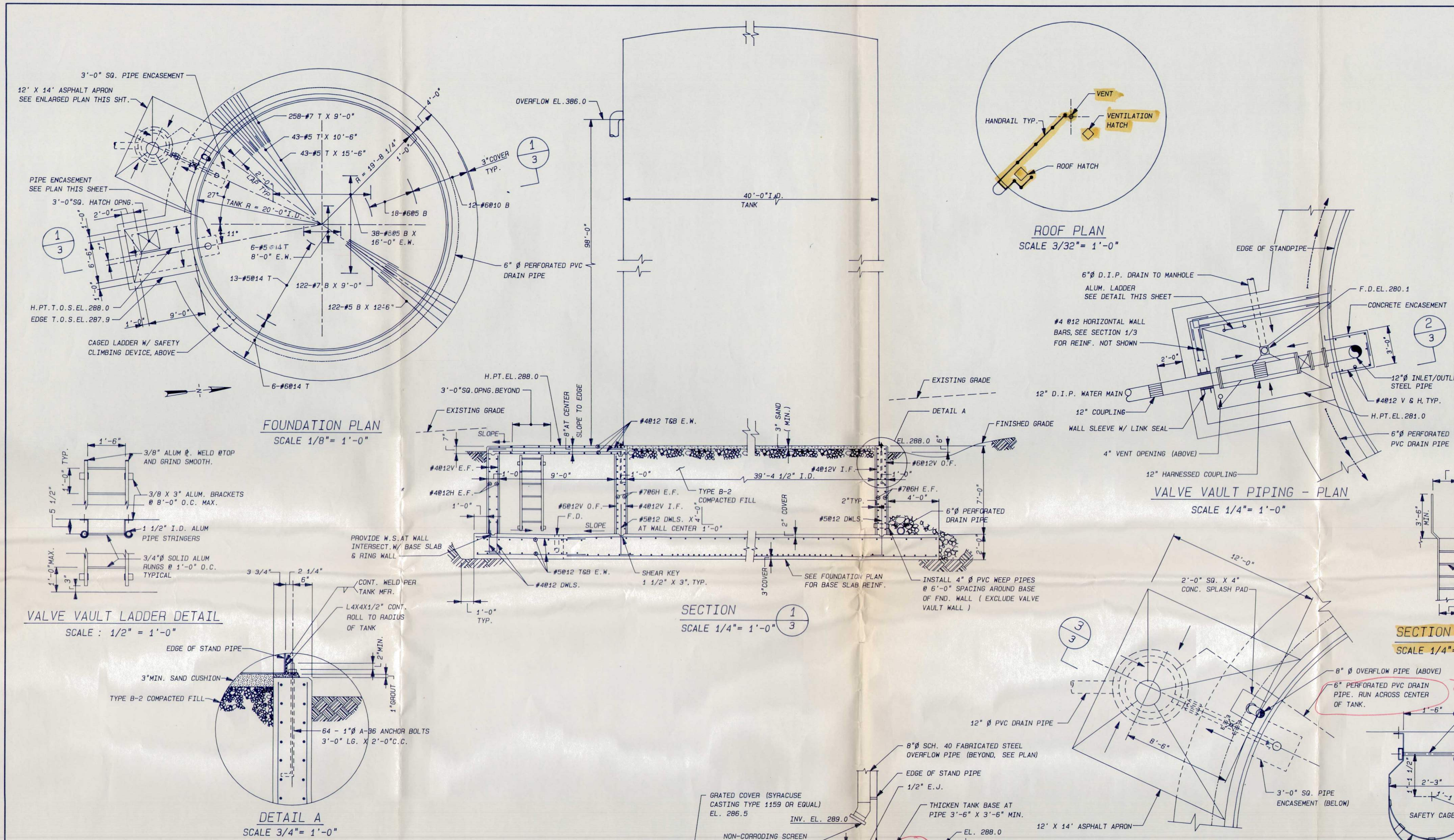
WATERWORKS CONSTRUCTION

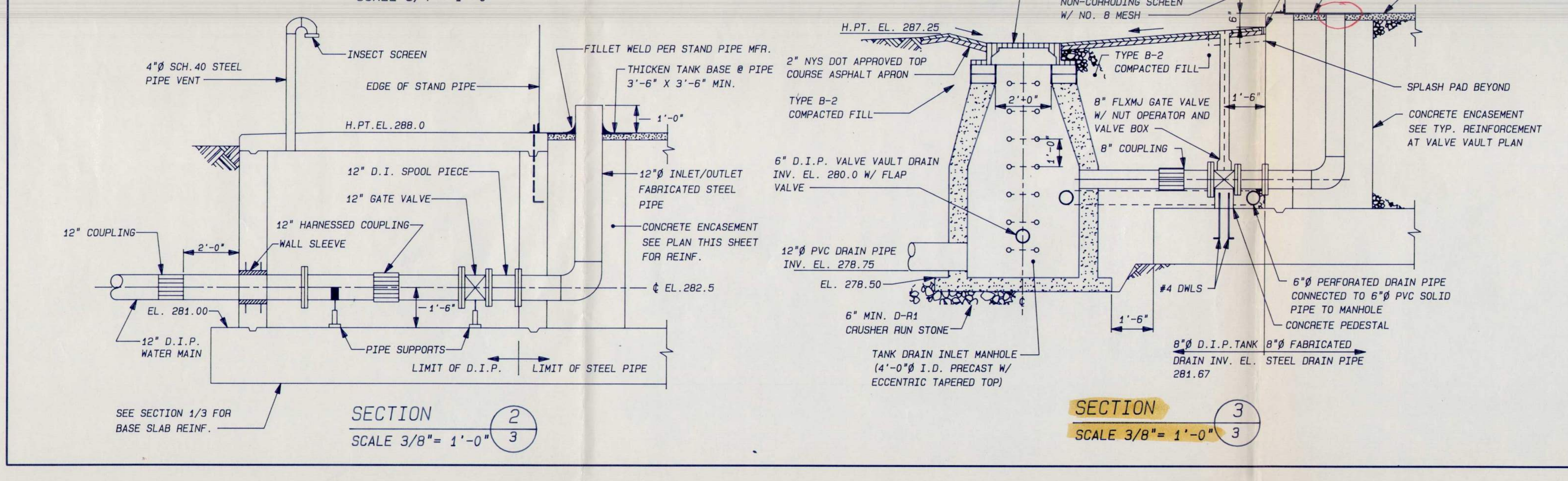
900,000 GALLON WATER STORAGE TANK

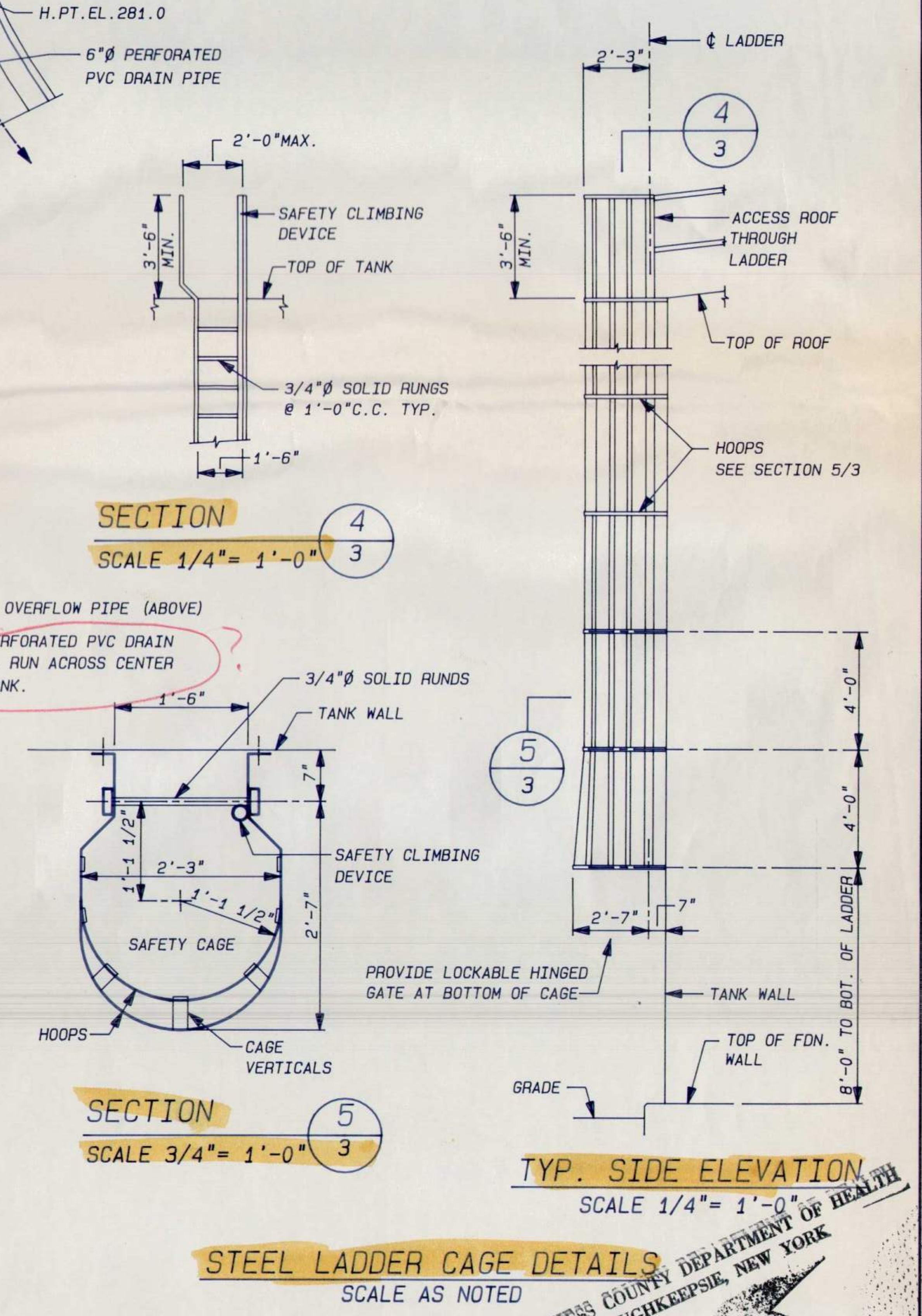
SITE PLAN AND ACCESS ROAD DETAILS

Stearns & Wheler
ENGINEERS AND SCIENTISTS
CAZENOVIA, NEW YORK — DARIEN, CONNECTICUT

JOB NO. 1479 | CONTRACT NO. 1 | SHEET 2 OF 4







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GENERAL NOTES

1. CONCRETE COMPRESSIVE STRENGTH - 4000 PSI @ 28 DAYS.
2. REINFORCING STEEL - ASTM A615 GR.60.
3. DETAILING STANDARD - ACI 315-80.
4. STRUCTURAL STEEL - ASTM A36.
5. ALUMINUM - ASTM B308, ALLOY 6061-T6 (AMERICAN STANDARD SHAPES, U.N.O.)
6. STRUCTURAL BOLTS - HIGH STRENGTH - ASTM A325. STAINLESS - ASTM F593.
7. WATERSTOP - 6" X 3/8" PVC CENTER BULB TYPE AS SHOWN ON DRAWINGS.
8. COMPACTED BACKFILL PLACED IN 8" MAXIMUM LAYERS.
9. PROVIDE 1" CHAMFER AT ALL EXPOSED CORNERS OF CONCRETE WALLS.
10. PLACE TWO #5 BARS DIAGONALLY AT ALL CORNERS OF OPENINGS IN WALLS OR SLABS.

DUTCHESS COUNTY DEPARTMENT OF HEALTH POUGHKEEPSIE, NEW YORK
These plans are approved. See first sheet for date and signature.

STATE OF NEW YORK · THOMAS CARROLL BURLY · PE 046011 · LICENSED PROFESSIONAL ENGINEER

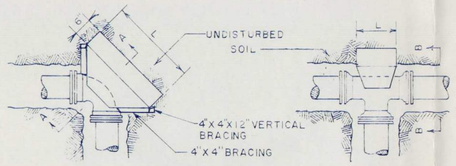
ISSUE NO.	DRAWN	DATE	CHECKED	DESIGNER	APPROVED	DATE
2	FOR CONSTRUCTION					
	RGM	10/7/88	DMH	FSM	TCB	10/7/88
1	FOR APPROVAL					
	RGM	9/13/88	DMH	FSM	TCB	9/13/88

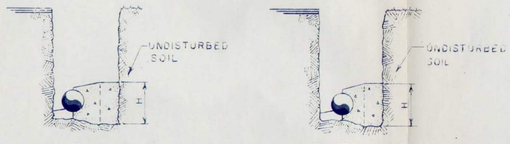
PROJECT SUPERVISOR — APPROVED

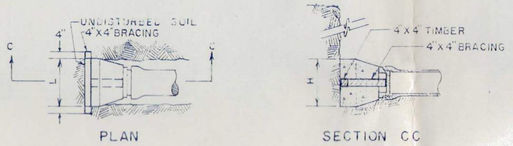
TOWN OF REDHOOK, NEW YORK
WATERWORKS CONSTRUCTION
900,000 GALLON WATER STORAGE TANK
STRUCTURAL PLAN, SECTIONS & DETAILS

Stearns & Wheler
ENGINEERS AND SCIENTISTS
CAZENOVIA, NEW YORK · WATERTOWN, NEW YORK · DARIEN, CONNECTICUT

JOB NO. 1479 | CONTRACT 1 | SHEET 3 OF 4







NOTE: SEE CHART ABOVE RIGHT "HORIZONTAL ANCHOR DIMENSIONS"

HORIZONTAL ANCHOR DIMENSIONS

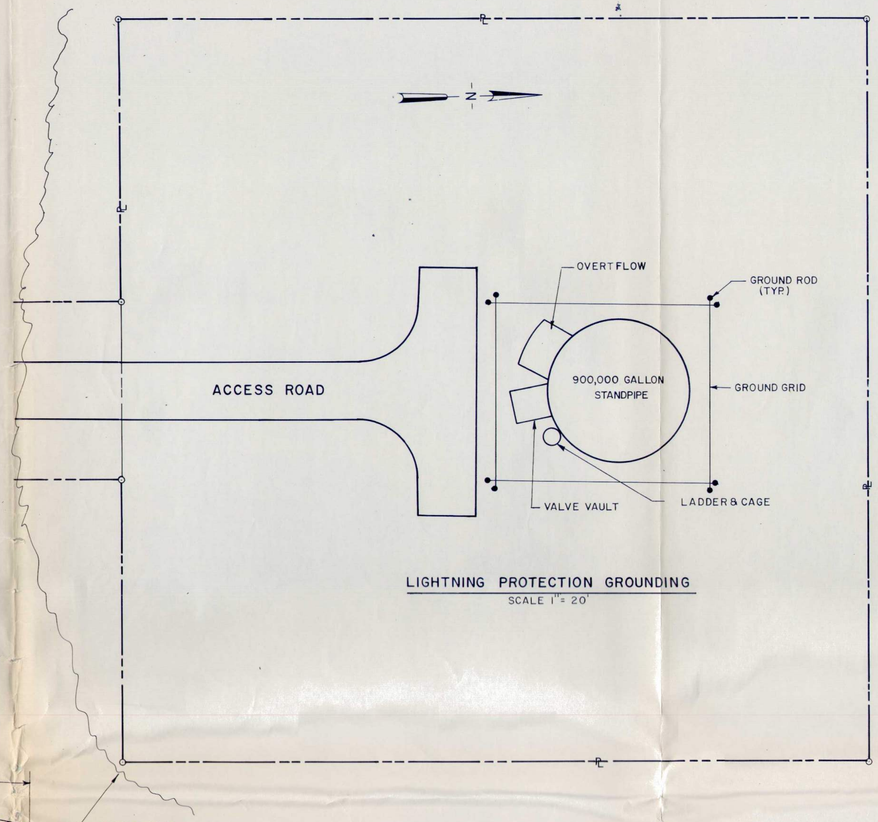
UP TO 250 P.S.I. WORKING PRESSURE

PIPE SIZE IN INCHES	PLUG, CAP, TEE, OR TAP SLEEVE H	PLUG, CAP, TEE, OR TAP SLEEVE L	90° BEND H	90° BEND L	45° BEND H	45° BEND L	22½° BEND H	22½° BEND L	11¼° BEND H	11¼° BEND L	PIPE SIZE IN INCHES
6"	1.5'	2.5'	2.0'	2.5'	1.5'	2.0'	1.0'	1.5'	1.0'	1.5'	6"
8"	1.5'	3.5'	2.5'	3.5'	2.0'	2.5'	1.5'	1.5'	1.0'	2.0'	8"
10"	2.5'	3.5'	3.0'	4.5'	2.5'	3.0'	1.5'	3.0'	1.0'	2.5'	10"
12"	3.5'	3.5'	3.5'	5.0'	3.0'	3.5'	2.5'	2.5'	1.5'	2.5'	12"
14"	3.5'	4.5'	4.0'	5.5'	3.5'	3.5'	2.5'	2.5'	1.5'	2.0'	14"
16"	4.0'	5.0'	4.5'	6.5'	3.5'	4.5'	2.5'	3.0'	2.0'	2.0'	16"
18"	5.0'	5.5'	5.5'	7.0'	4.0'	5.0'	3.0'	3.5'	2.0'	2.5'	18"
20"	5.5'	6.0'	6.0'	7.5'	4.5'	5.5'	3.5'	3.5'	2.5'	2.5'	20"
24"	6.0'	7.5'	7.0'	9.5'	5.0'	7.0'	4.0'	4.5'	3.0'	3.0'	24"

VERTICAL ANCHOR DIMENSIONS

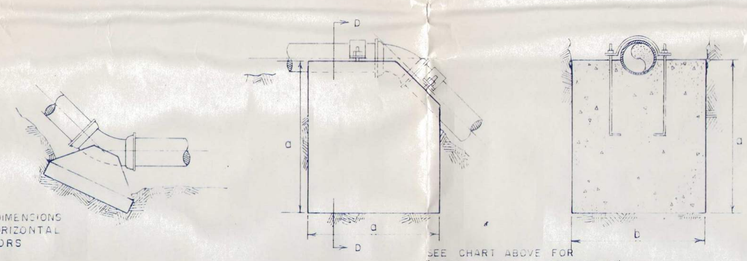
PIPE SIZE	DIMENSION	45° BEND 150 PSI	45° BEND 300 PSI	22½° BEND 150 PSI	22½° BEND 300 PSI	11¼° BEND 150 PSI	11¼° BEND 300 PSI
6"	a	3'	3'-6"	2'	3'	2'	2'-6"
	b	5'	5'	4'	4'	3'	3'
8"	a	3'-6"	4'-6"	2'-6"	3'-6"	2'-6"	3'
	b	5'	5'	4'	4'	3'	3'
10"	a	4'-6"	5'-6"	3'-6"	4'	3'	3'-6"
	b	5'	5'	4'	4'	3'	3'
12"	a	5'	6'-6"	3'-6"	5'	3'	4'
	b	5'	5'	4'	4'	3'	3'
14"	a	6'	7'-6"	4'-6"	5'-6"	3'-6"	4'-6"
	b	5'	6'	4'-6"	5'	3'	3'-6"
16"	a	6'	7'-6"	5'	6'-6"	4'	4'-6"
	b	6'	7'	4'	5'	3'	4'-6"
18"	a	6'-6"	8'	5'-6"	6'-6"	4'-6"	5'
	b	6'	7'	4'	5'-6"	3'	4'
20"	a	7'-6"	9'	5'-6"	7"	4'-6"	5'-6"
	b	6'-6"	7'	5'	6'	4'	4'-6"
24"	a	7'-6"	10'	6'	8'	5'-6"	6'
	b	7'	8'	5'-6"	6'	4'	6'

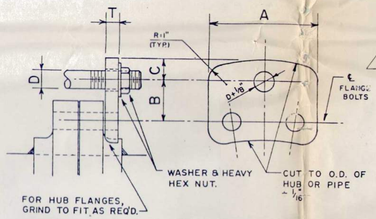
NOTE: PRIOR TO PLACING OF CONCRETE ANCHORS, WRAP ALL FITTINGS WITH 8 MIL. THICK POLYETHELENE.



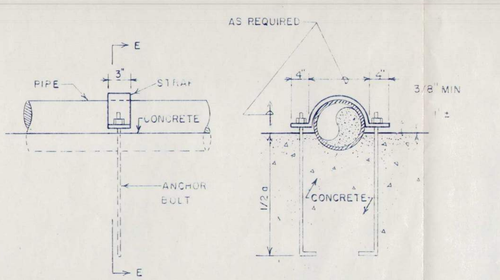
LIGHTNING PROTECTION GROUNDING
SCALE 1" = 20'

NOTE:
UNDERGROUND FACILITIES, STRUCTURES AND UTILITIES HAVE BEEN PLOTTED FROM AVAILABLE SURVEYS AND RECORDS, AND THEREFORE THEIR LOCATIONS MUST BE CONSIDERED APPROXIMATE ONLY. THERE MAY BE OTHERS, THE EXISTENCE OF WHICH IS PRESENTLY NOT KNOWN.





FLANGED PIPE HARNESS DETAIL



CONCRETE ANCHOR DETAILS

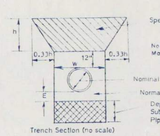
VERTICAL BEND ANCHOR STRAP DETAIL

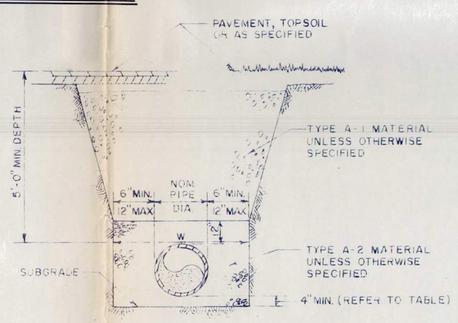
NOT TO SCALE

ALL EXPOSED PORTIONS OF ANCHOR STRAPS TO RECEIVE MINIMUM 2 FIELD COATS OF BITUMASTIC MATERIAL

TABLE OF QUANTITY FACTORS

Nominal Pipe Dia. in Inches	Excavation Below subgrade, Trench Lining Material and Special Pipe Foundation, C.Y. per L.F. of Trench per Foot of Depth (D = 7 Feet	Special Backfill Material, C.Y. per L.F. of Trench (h = Depth in Feet Above Top of Foundation)	Dia. Depth in Inches Between Bottom of Pipe and Bottom of Normal Pipe Foundation
4	0.09	0.09(h) + 0.012(h²)	4
6	0.10	0.10(h) + 0.012(h²)	4
8	0.10	0.10(h) + 0.012(h²)	4
10	0.11	0.11(h) + 0.012(h²)	4
12	0.12	0.12(h) + 0.012(h²)	4
14	0.12	0.12(h) + 0.012(h²)	4
15	0.13	0.13(h) + 0.012(h²)	4
16	0.13	0.13(h) + 0.012(h²)	4
18	0.14	0.14(h) + 0.012(h²)	6
20	0.14	0.14(h) + 0.012(h²)	6
21	0.15	0.15(h) + 0.012(h²)	6
24	0.16	0.16(h) + 0.012(h²)	6
27	0.17	0.17(h) + 0.012(h²)	8
30	0.18	0.18(h) + 0.012(h²)	8
36	0.19	0.19(h) + 0.012(h²)	8
42	0.23	0.23(h) + 0.012(h²)	8
48	0.25	0.25(h) + 0.012(h²)	8
54	0.28	0.28(h) + 0.012(h²)	8

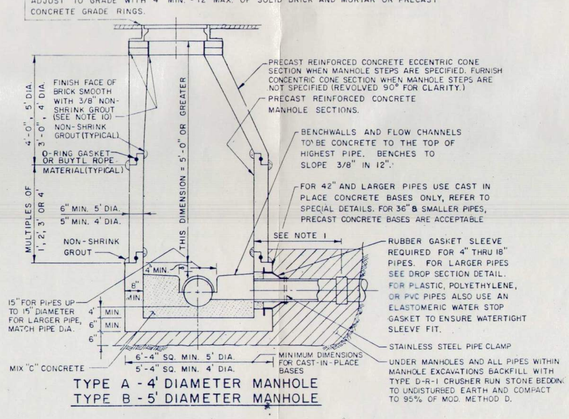




NORMAL TRENCH DETAILS

1) SAFETY STANDARDS OR SAFE WORKING CONDITIONS MAY DICTATE A MODIFICATION IN TRENCH WIDTH OR TRENCH SIDE SLOPES. CONTRACTOR IS RESPONSIBLE FOR MEETING ALL APPLICABLE SAFETY STANDARDS AND PROVIDING SAFE WORKING CONDITIONS.

2) MAXIMUM PAYMENT LIMIT (W) - WHERE USE OF SHEETING OR TRENCH SHIELD IS REQUIRED BY CONTRACTOR TO MEET SAFETY STANDARDS AND TO PROVIDE SAFE WORKING CONDITIONS DUE TO DEPTH OF PIPE OR SOIL CONDITIONS, THEN MAXIMUM LIMIT TO BE OUTSIDE WIDTH OF SHEETING OR SHIELD AND QUANTITIES TO BE COMPUTED ON THAT WIDTH AS MEASURED BY THE ENGINEER.



TYPE A - 4' DIAMETER MANHOLE
TYPE B - 5' DIAMETER MANHOLE

DUTCHESS COUNTY DEPARTMENT OF HEALTH
POUGHKEEPSIE, NEW YORK
These plans are approved and first sheet for date and signatures.

STATE OF NEW YORK
THOMAS CARROLL MORLEY
PE 046011
LICENSED PROFESSIONAL ENGINEER

NO.	PURPOSE	DATE	DRAWN	DESIGNED	APPROVED	DATE
2	FOR CONSTRUCTION MS 10/88	Cad E	CJD	TG		11/1/88
1	FOR APPROVAL MS 8/88	Cad E	CJD	TG		9/1/88

PROJECT SUPERVISOR: Michael Elliott
APPROVED: Stearns & Wheler

TOWN OF RED HOOK, NEW YORK
WATERWORKS CONSTRUCTION

MISCELLANEOUS DETAILS

Stearns & Wheler
ENGINEERS AND SCIENTISTS
CAZENOVIA, NEW YORK DARIEN, CONNECTICUT

JOB NO. 1479 | CONTRACT NO. 1 | SHEET 4 OF 4

Tighe&Bond

APPENDIX B

RD

TOWN OF RED HOOK, NEW YORK

WATER DISTRICT NO. 1

WATER STORAGE FACILITIES STUDY

STEARNS & WHELER
Engineers and Scientists
10 Albany Street
Cazenovia, New York 13035

March 1988

Stearns & Wheler
ENGINEERS AND SCIENTISTS

CAZENOVIA, NEW YORK WATERTOWN, NEW YORK
DARIEN, CONNECTICUT

March 8, 1988

Re: Red Hook Water District No. 1
Water Storage Study

Town of Red Hook
107 South Broadway
Red Hook, NY 12571

Attention: Mr. John Gilfeather, Supervisor

Gentlemen:

We are pleased to submit our Final Report on the water storage requirements for Red Hook Water District No. 1. This study was conducted to determine the needs, schedule and cost for providing water storage for the District. Storage facilities are necessary to equalize pressures throughout the water system; to reduce the water hammer that occurs when the well pumps start; to provide storage to meet future peak hourly demands; and provide emergency storage capabilities, in the event of well equipment failure.

The report identifies a phased program for the design and construction of a water storage standpipe and associated pipelines and pumping station improvements. The project schedule and estimated project costs for the recommended improvements are included.

Upon review and approval by the Town, this report should be submitted to the Dutchess County Health Department and New York State Audit Control (with the appropriate applications) for review.

We wish to thank the Town of Red Hook for the opportunity to conduct the water storage investigations. We look forward to working with you on the subsequent design and construction of the recommended improvements.

Very truly yours,

STEARNS & WHELER
Engineers and Scientists

Thomas C. Burkly, P.E.
Partner

TCB/sc
Encl.

Reply to 10 Albany Street, Cazenovia, N.Y. 13035 (315) 655-8161
FAX: (315) 655-4180

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SECTION 1. INTRODUCTION

1.01 Background

The Town of Red Hook Water District No. 1 is located in Dutchess County, northwest of the Village of Red Hook, north of Route 199 and east of Route 9G. This area was previously served by the Annandale Water Works, Inc. A petition of residents in the area requested the Town to form a Water District to purchase, operate, maintain, and expand (as necessary) these facilities. A March 1980 Report and June 1982 supplement, by Ronald H. LaBerge, P C. identified the conditions of the Annandale Water Works System, and a three-phased program for purchasing and expanding water service in the area. This program consisted of the following:

Phase 1 - Form a Water District, acquire the system and develop a new groundwater source;

Phase 2 - Construct a water storage tank and associated pipelines in the Northwest section of the District;

Phase 3 - Construct a second storage tank and associated pipelines in the Southwest section of the District.

In 1984, Water District No. 1 was approved by New York State Audit Control allowing for the completion of the Phase 1 facilities. In November 1987, Stearns & Wheler Engineers was retained to study and make recommendations for the Phase 2 Water Storage Tank and Pipelines. The water storage facilities are necessary to equalize pressures throughout the water system; to reduce the water hammer which occurs when the well pumps start; to provide storage to meet future peak hourly water demands; and provide emergency storage capabilities in case of equipment failure at the well site. At this time, the need to provide high fire flow rates is considered less important, by District representatives, due to the nature of development in the area; the fire department capabilities and fire insurance criteria.

1.02 Purpose of This Report

This report presents a summary of the findings and recommendations relative to the status of the Water District No. 1 facilities and the water storage

needs for the District. The report includes estimated capital costs and schedules for the recommended improvements and identifies facilities for future development.

SECTION 2. WATER SYSTEM INVESTIGATION

2.01 Existing Conditions

Figure 1 presents a general plan for Water District No. 1. This plan, based on a February 1985 map prepared by LaBerge, P.C., has been updated in accordance with conversations with district personnel. The original Annandale Water Company system reportedly consisted of 36,000 linear feet of 6-inch transit pipe. Some hydrants were installed in the system as blow offs and clean-outs. Reportedly these hydrants were not intended for fire flow purposes, since the well pump capacity is 250 gallons per minute (gpm).

Well Supply

The Phase 1 activities included the location and development of a new groundwater source near the Saw Kill, at the end of Willow Brook Lane. This source consists of two wells, in close proximity to each other, each with a capacity of about 250 gallons per minute. A control building, at the well site, houses the instrumentation and control equipment (for the wells) and a hypochlorite feed system for disinfection. A hydromatic system was installed, at the site, to control pump starts and reduce pressure fluctuations, on pump startup.

Reportedly the well quality and quantity is adequate for present and future needs of the District. This quantity and quality should be periodically verified as the District expands. On December 9 and 10, 1987, the following were noted at the well pumping station. Normal operating pressure (at the Control Building) was between 80 and 100 psi. Starting Pump No. 1 causes pressure surges (at the pumping station) to exceed 150 psi. Starting Pump No. 2 causes pressure surges to exceed 125 psi. These pumping surges cause the station piping to rattle and periodically cause the pressure relief valve (PRV) to open, discharging water. Occasionally, the PRV fails to seat completely after a pressure surge stops. This causes continuous loss of water at the station. A flow control valve was recently installed to dampen pressure surges during pump startup. This valve is presently not operational.

System water demands cause the pumps to start between 4 and 8 times an hour (causing an equal number of pressure surges). It appears that much of the piping movement, at the station, is due to the unrestrained nature of the

piping. This piping can be shaken by hand. Some "cavitation" was heard while running Pump No. 2.

Water System

Because of the lack of major distribution system storage, the water system experiences large pressure fluctuations during pump startup and shutdown. In addition to the 250 gpm supply capacity, the 6-inch pipelines throughout the system are inadequate for substantial fire flows (greater than 500 gpm) without additional "looping".

On December 9 and 10, 1987, system pressures were monitored in the distribution system. A continuous recording pressure gage was installed at 28 Colonial Drive. This house is apparently the highest elevation in the system. The ground elevation behind this house is five to ten feet lower than the top of the hill proposed for a future tank. The pressure readings at this house fluctuated between 15 and 55 psi with a normal operating range between 30 and 40 psi. Pressure fluctuations coincided with well pump startup and shutdowns. Future water storage should maintain a pressure between 30-40 psi in this area. However, pressure changes would be less frequent with system storage.

Construction of new homes in areas adjacent to the district will necessitate construction of additional pipelines. Wherever possible these new lines should be "looped" into the existing water system by at least two connections. Significant growth is now planned, both within the District and in areas adjacent to the District. For purposes of this report, future conditions for the system assumes construction of the Phase 3 pipelines shown on Figure 1, as the District grows from its present 330 customers to over 600 customers, as proposed. The phasing of these pipelines and their exact location will be dependent on the developers' proposals.

2.02 Water Demands

The system currently serves about 330 customers (about 1100 people). Water sales for the last quarter of 1986 and the first three quarters of 1987 equaled 19.1 million gallons (52,000 gallons per day). The reported existing annual average daily pumping at the well site is about 75,000 gallons per day with a peak day of about 130,000 gallons per day.

Based on the June 1982 system report, the District will ultimately contain about 600 customers with a population of about 2100 people. The ultimate average daily production for the total District is estimated to be 210,000 gallons per day with a maximum day of about 400,000 gallons per day. The ultimate peak hourly rate is estimated at 530,000 gallons per day.

The current fire flow capacity for the system is less than 250 gallons per minute (gpm). Apparently, the existing fire department's use of local ponds is adequate for present conditions. However, as the District grows and expands, the need to provide fire flows from the water system should be considered. For purposes of this report the estimated future fire flow rate, for the ultimate District, would range between 500 and 1000 gallons per minute depending on the location and construction methods for future developments. For hydraulic computations, it was assumed that at least 500 gallons per minute would be available to any single area (for fire purposes) and that the wells and storage facilities could provide up to 1,000 gallons per minute into the system as a whole. If the ultimate conditions of the District require greater fire flow rates, additional pipelines, or a second storage tank may be necessary.

2.03 Hydraulic Analysis

As discussed above, the current pressure at 28 Colonial Drive (the apparent high point) range from 15 to 55 psi (USGS Elevation 325 to 415) with normal pressures of 30 to 40 psi (USGS Elevation 360 to 380). At least 20 psi should be maintained in the water system (at the hydrant in the street) under emergency or fire flow conditions. This relates to a USGS elevation of about 320 feet in the Colonial Drive area. Therefore, hydraulic analysis for this report was based on providing normal operating water elevations, in the Colonial Drive area, of 360 feet to 380 feet (USGS) with minimum water service elevations, under emergency conditions, at 320 feet.

For the future tank proposed south of Colonial Drive (Phase IV), hydraulic conditions are such that the overflow of the tank would be set at elevation 380. A ground elevation of about 290, results in a 90-foot high tank at this site.

For the tank off Kelly Road (on a lot owned by the District) the overflow elevation must relate to the above elevation plus allowances for headloss in the system under varying flow conditions. Hydraulic computations for the existing system (at present peak rates of flow without the well pumps on) show that the

overflow for the Kelly Road site should be at elevation 395. The existing site elevation (about 285), results in a 110-feet high tank. With the tank at this elevation, 500 gpm fire flow rates could be maintained for much of the District. However, due to the length of the 6-inch pipeline along Manner Road, 500 gpm could not be provided to Colonial Drive.

For hydraulic computations for this report, it was assumed that at least the pipeline loop between Linden Avenue and Trow Boulevard (with a connection to Aspinwall Road), would be constructed as shown in Figure 1. This loop is considered the minimum water system reinforcement needed for the ultimate water district (600 customers). Hydraulic analysis of this situation indicate that the overflow elevation of 395 is still needed to meet future system peak hour demand. In addition, the above loop allows up to 500 gallons per minute to flow to the Colonial Drive area while maintaining adequate pressures (20 psi) in this area. Under these conditions, with the well pumps running, over 750 gallons per minute could be delivered to the Colonial Drive area with minimum pressures being maintained.

2.04 Distribution Storage Needs

Current New York State Health Department guidelines require at least an average day capacity in storage. District representatives indicated a desire to have at least two days' storage available, if possible, in case of well pump failure. These criteria establish minimum storage needs of 100,000 gallons and 200,000 gallons under existing conditions and 200,000 gallons and 400,000 gallons under future district conditions, respectively. To meet the future fire flow rates and peak hourly conditions in the system (with the well pump running), require about 250,000 gallons of storage.

The above hydraulic calculations show the need for a 100-feet high tank, at the Kelly Road site, to maintain adequate pressures in the distribution system. The required tank height dictates that the tank will be either a steel standpipe or (steel) elevated tank. A prestressed concrete tank is not feasible, for this application, since construction techniques generally limit these tanks to be less than 50 feet high. If a 50-feet high tank were constructed, at the Kelly Road site, the pressures at Colonial Drive would be about 20 psi when the tank is full and much less as the water surface drops with water use.

To meet the above storage and height criteria, four options were investigated for the water tank at the Kelly Road site:

1. 40-foot Diameter Standpipe (250,000 gallons in the top 26 feet) - This would meet minimum standards for storage (for both present and future conditions) in the upper levels of the tank. The extra "emergency" storage requested by the District representation is below the 26 foot level. This tank would have total storage capacity of about 1,000,000 gallons.

2. 250,000 gallon Elevated Tank - This tank would meet current and future minimum standards for storage capacity but would not be able to provide the two days' storage requested by the District.

3. 400,000 gallon Elevated Tank - This would meet minimum standards for the future conditions, in addition to providing about two days' storage total.

4. 30 feet Diameter Standpipe - This tank would provide about 130,000 gallons in the top 25 feet which meets the present minimum storage requirements for the system. About 210,000 gallons would be available for this system in the top 40 feet. This would require the future pipelines to enable the use of the top 40 feet without going below minimum operating pressures. Over 250,00 gallons is available in the top 50 feet for fire flow purposes. The total tank capacity is about 550,000 gallons.

The construction costs for the tank and foundation (including coatings) are presented as Table 1. Alternate 4, in addition of being the least expensive alternate, will meet current and future conditions of storage for the system, with appropriate pipeline construction. In addition, the smaller tank will allow a more frequent "turnover" of water during normal operating conditions (compared to the 40 foot diameter standpipe). With future developments "looping" the system (similar to that shown on Figure 1), the tank can be fully utilized. This alternate minimizes the cost to the current District customers and would postpone costs for future tanks (if necessary) when more people are serviced.

SECTION 3. RECOMMENDED PLAN

3.01 General

The Town of Red Hook Water District No. 1 should authorize the design of the Phase II facilities shown in Figure 1 including the following:

A. A 30-foot diameter standpipe on Site A with an overflow elevation of 395 feet (USGS). A zinc metal coating is recommended to reduce maintenance on the tank.

B. An 8-inch pipeline along Aspinwall Road between Manor Road and the existing pipeline (near the Saw Kill). Construction of this pipeline was authorized in January 1988.

C. Minor modifications to the well pumping station, including the following:

- Repair the flow control valve.
- Construct thrust restraints for the discharge piping.
- Revise pump controls to start on tank level, rather than system pressure.
- Test (quantity and quality) of both production wells.

An estimated schedule for the design and construction of the Phase II facilities is presented as Figure 2. This schedule is controlled by the 10-month estimate to receive approval from New York State Audit and Control for the revised bonding limit for the District. This approval is necessary before the construction contract is awarded.

The Water District should begin planning for the Phase III and Phase IV improvements, identified in Figure 1. These improvements should be constructed (where possible) simultaneously with future developments within the District or adjacent areas. Planning should include the following:

A. Purchasing Site B (ground elevation about 295) and applicable rights-of-way for the access road and pipelines.

B. Identifing potential sites for additional wells should they become necessary to meet future demands of the system.

C. Installing pipelines, shown in Figure 2, completing loops within the system including easements and rights-of-way. These pipelines will reduce the long "dead ends" in the system (as requested by the Health Department) in addition to improving the system hydraulic capacity. The developers should install major portions of the pipelines as part of their proposed subdivisions. The pipeline locations, shown in Figure 1, are tentative and will be dependent upon final configurations of future developments.

3.02 Estimated Cost and Financing

As shown in Table 2, the estimated project cost for the Phase II improvements, including construction, engineering, legal and miscellaneous costs, is $670,000. These costs were obtained in January 1988 with an Engineering News Record Construction Cost Index (ENRI) of 4450. The Project Cost was then escalated to a January 1989 Award date with an estimated ENRI of 4600. For purposes of this report, it is estimated that financing will be at 8% interest, for a 25-year period. As shown on the interest table presented in Appendix A, this results in a first-year annual cost of $74,000. This schedule is based on New York State Municipal Finance Laws and should be evaluated by the Town's financial advisor. As noted, this method of financing results in a decrease in the annual payment over the period of the bond.

The 1987 district budget allowed for a $40,000 principal payment (against the original $400,000 loan for the Phase I projects). In addition, about $23,000 of interest was paid on the bond anticipation notes, bringing the total principal and interest payment to $63,000. As shown in Appendix A, long-term bonding for the Phase I improvements (20 years at 8% interest) would result in a first-year total annual payment of about $44,000. This would allow an annual payment of about $20,000 to be applied to the bonding for the Phase II project.

In addition, the District's current income allowed about $40,000 per year for pipeline additions and other system improvements. Allocating about $20,000 of this item for the Phase II improvements, along with the above, results in about $40,000 per year from the existing budget, that could be applied to the principal and interest payments for the Phase II facilities. This results in an

additional annual cost to the District of about $34,000 or a $103 per year additional charge per customer (330 customers), or an increase in water rates of about $1.80 per thousand gallons sold.

As noted above, most of the Phase III facilities should be constructed by developers building within or adjacent to the district. However, for purpose of the bonding limit for New York State Audit and Control, it is recommended that the district plan on an additional $130,000 expenditure, at this time, to be used, when needed, to complete portions of the Phase III pipelines and to purchase necessary rights-of-way for these facilities. This $130,000 represents about one-quarter of the estimated pipeline costs for Phase III facilities. As noted above, the annual principal and interest payments for both the Phase I and Phase II facilities will decrease over the period of the bonds. It is expected that this decrease, in addition to the increased sales of water for new customers, will offset the annual cost to the customer associated with these Phase III facilities.

It is expected that the Phase IV improvements (the storage tank on Site B) will not occur until far in the future, therefore, the cost for financing of this project should be re-evaluated when it is needed.

SECTION 4. CONCLUSIONS AND RECOMMENDATIONS

The following sections present the conclusions and recommendations of the water storage investigations for the Town of Red Hook Water District No. 1.

4.01 Conclusions

A. The existing wells have 250 gallon per minute (360,000 gpd) pumps which are able to meet peak hourly demands (estimated to be over 200,000 gallons per day rate). Future peak hourly rates are estimated to be over 530,000 gpd (360 gpm). The existing hydropneumatic tank was installed to dampen pressure surges (during pump startup) but provides only minor system storage. No effective system storage exists in the system.

B. The Department of Health has requested system storage of about one day capacity. The District needs system storage to equalize pressure throughout the system; reduce the frequency of pressure surges from pump starts; meet future peak hour demands, and to provide emergency storage in case of mechanical failure at the well. Due to the nature of the existing area and fire department capabilities, District representatives do not perceive meeting high fire flow rates to be a primary concern at this time. The existing 6-inch piping throughout the system would prevent fire flows of 500 gpm or greater to many areas of the system. However, storage could provide lower rates of fire flow (250 to 500 gpm) to the existing system. Future pipeline looping could allow the system to meet the 500 gpm fire flow requirements as the District expands.

C. The system, at the well pumping station, operates between 80 and 100 psi. The well pumps starting and stopping causes pressure surges at the pumping station to exceed 150 psi. The surges have caused the pressure relief valve in the station to open. This valve has periodically stuck open, causing water to be lost.

D. Based on previous reports, the district has purchased a site for a storage tank on a hill east of Kelly Road, in the northeast section

of the district. The hydraulics of the system requires that the tank overflow elevation be at least 395 feet (USGS).

E. A 30-foot diameter standpipe would provide about 130,000 gallons of storage in the top 25 feet which would be sufficient to meet existing pressures and provide the one-day storage for existing conditions. Future pipeline modifications could allow the use of the top 50 feet of the tank, making over 250,000 gallons available for storage. This is enough capacity for future average day conditions and maintaining fire flows (with minimum system pressures of about 20 psi). The total tank capacity would be over 550,000 gallons which could provide over two days of storage for emergency conditions, under future conditions, although low pressures could be expected at the higher elevations in the water system.

F. Phase II improvements include construction of a 30-foot diameter standpipe. The estimated project cost (see Table 2) is $670,000. The estimated schedule for the project results in the completion of the project by December 1989 (see Figure 2). Based on the above project costs, the annual principal and interest payments for a $670,000 bond (at 8% for 25 years) is about $74,000. By offsetting these annual costs with reduced principal and interest payments, on the Phase I bonding, and using a portion of the existing improvements funds, the increased annual cost for the Phase II facilities would be about $34,000 per year. This results in a $103 per customer per year charge for the Phase II facilities.

G. The Phase III pipelines (shown in Figure 1) will be needed to meet future peak hourly rates of flow and to provide fire flows greater than 500 gpm to all points in the system. It is estimated that most of the pipelines can be installed by developers, as part of the expansion within the district and in areas adjacent to it.

4.02 Recommendations

A. Upon approval by the Town, Water District No. 1 should submit this Report to the Dutchess County Health Department for their review.

B. Red Hook Water District No. 1 authorize the final design for the Phase II facilities.

C. That the District prepare submittal to the New York State Audit and Control, increasing the District bonding limit by $800,000. This includes an additional $130,000 for future costs to the District for completing some of the Phase III pipelines and purchasing land and rights-of-way. If, at this time, negotiations can be completed with the developer south of the District to provide water, the submittal to Audit and Control should include a revision of the District boundary.

D. In review of plans for future developments, the Town should incorporate potential for construction of pipeline loops shown as the Phase III facilities. All developments should consider connecting to the existing water system at at least two locations, creating a "loop" through the newly developed areas.

E. Apparently, the existing wells have sufficient quantity and quality for existing conditions. However, the wells should be periodically tested to insure the continued capabilities and potential for meeting future growth within the District.

F. Based on the above additional costs, the District should evaluate financing capabilities and method of payment for the Phase I and Phase II facilities. The District should re-evaluate the split of annual payments between the ad valorem taxes and water rates.

G. The District should update their existing water system maps to incorporate pipelines added during recent developments.

TABLES

TABLE 1

ALTERNATIVE STORAGE TANKS
ESTIMATED CONSTRUCTION COST*

40-feet diameter Standpipe	$450,000
30-feet diameter Standpipe	330,000
400,000-gallon Elevated Tank	550,000
250,000-gallon Elevated Tank	430,000

*Tank at the Kelly Road Site, including foundation and interior and exterior coatings; site work not included.

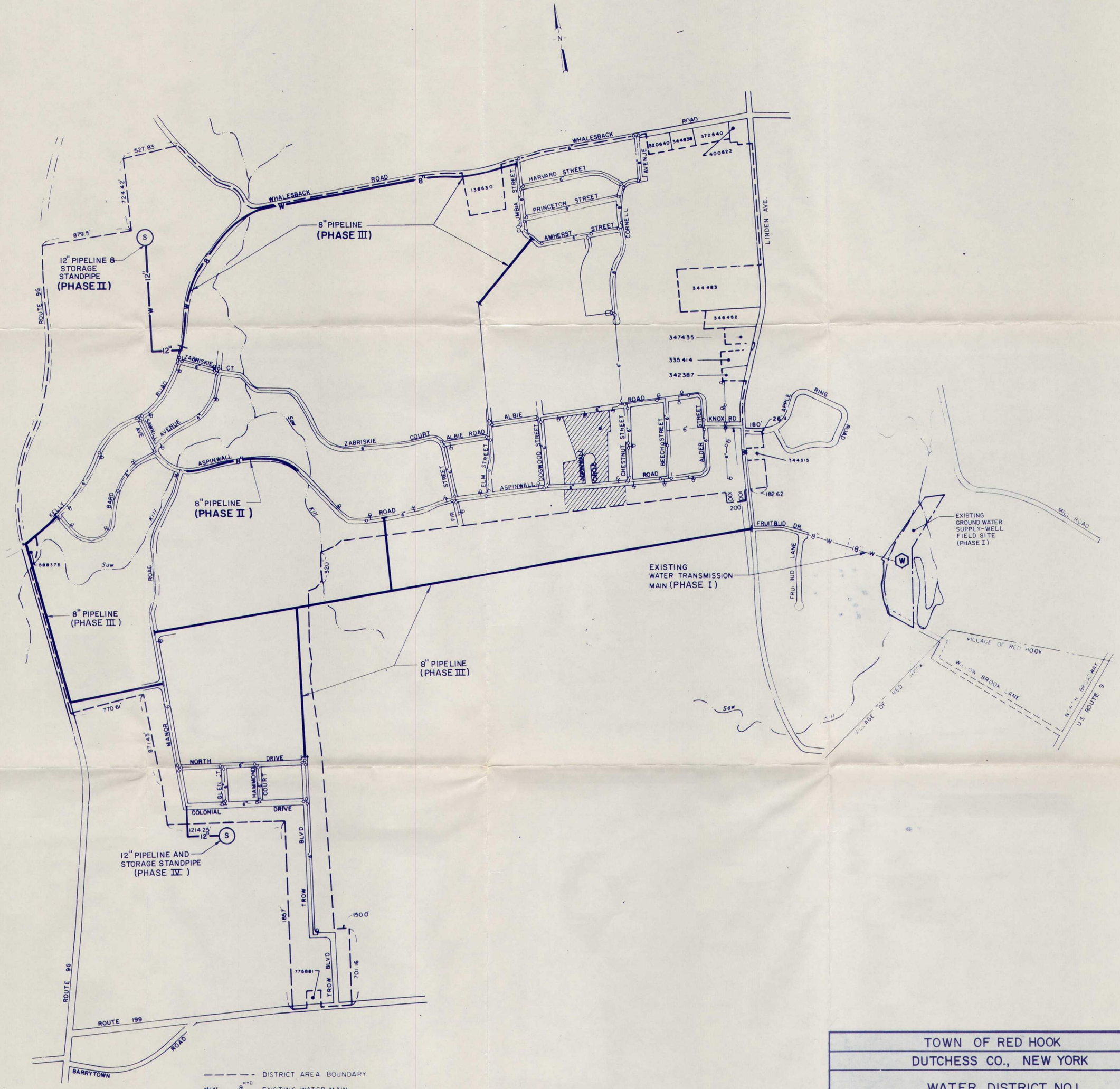
TABLE 2

ESTIMATED PROJECT COST

Construction:		
Mobilization	$ 10,000	
Site work	22,000	
12-inch tank site piping	50,000	
Steel standpipe	330,000	
Electrical/instrumentation	30,000	
Pumping station modifications	20,000	
Contingencies	73,000	
TOTAL		$535,000
Engineering:		
Design	$ 27,000	
Soil borings	8,000	
Surveys	5,000	
Approvals/District	5,000	
Construction	35,000	
TOTAL		$ 80,000
Legal and Miscellaneous Costs:		35,000
TOTAL, JANUARY 1988 (ENRI 4450)		**$650,000**
TOTAL, JANUARY 1989 (ENRI 4600)		**$670,000**

FIGURES

FIGURE NO.1



NOTE: BASED ON FEB. 20, 1985 "WATER DISTRICT NO. 1 GENERAL PLAN" BY LABERGE ENGINEERING & CONSULTING GROUP LTD.

TOWN OF RED HOOK
DUTCHESS CO., NEW YORK

WATER DISTRICT NO.1 GENERAL PLAN

Stearns & Wheler
ENGINEERS AND SCIENTISTS
CAZENOVIA, NEW YORK — DARIEN, CONNECTICUT

JOB NO. 1479	SCALE: 1" = 500'	MARCH, 1988

DATAPRINT N4235

Tighe&Bond

APPENDIX C

HVP 2017

INSURANCE SERVICES OFFICE, INC.

4 B EVES DRIVE SUITE 200 MARLTON, NJ 08053 (856) 985-5600 FAX (856) 985-6464

October 11, 2002

Mr. John Gilfeather, Supervisor
Town of Red Hook
7340 So. Broadway
Red Hook, NY 12571

RE: Public Protection Classification Results
Red Hook FPD, Dutchess County, NY

Dear Mr. Gilfeather:

We wish to thank you and the other community officials for your cooperation during our recent Public Protection Classification (PPC) survey. ISO is the leading supplier of statistical, underwriting, and actuarial information for the property/casualty insurance industry. Most insurers use the PPC classifications for underwriting and calculating premiums for residential, commercial and industrial properties.

ISO has completed its analysis of the structure fire suppression delivery system provided in your community. We are very pleased to report that the resulting classification is a Class 4/9*. This is an improvement from the former classification of Class 5/9*. That means your community's fire suppression services are improving in the face of the demands of a changing environment. Congratulations on this recognition of your commitment to serve the needs of your community's property owners and residents.

Enclosed is a summary of the ISO analysis of your fire suppression services. If you would like to know how your community's classification could improve, or if you would like to learn about the potential effect of proposed changes to your fire suppression delivery system, please call us at the phone number listed below.

The PPC program is not intended to analyze all aspects of a comprehensive structure fire suppression delivery system program. It is not for purposes of determining compliance with any state or local law, nor is it for making recommendations about loss prevention or life safety.

* "4" is us
"9" is for properties beyond 1000' of a hydrant, but within 5 mi. of a fire station

If you have any questions about your classification, please let us know.

Sincerely,

Public Protection Department
(856) 985-5600 Ext. 403

nf

Encl.

cc: Chief Arvine "Bucky" Coon, Red Hook Fire Department
Mr. Henry VanParys, Chairman, Town Water Board

THE ISO PUBLIC PROTECTION CLASSIFICATION (PPC) PROGRAM

ISO's PPC program evaluates communities according to a uniform set of criteria defined in the Fire Suppression Rating Schedule (FSRS). This criteria incorporates nationally recognized standards developed by the National Fire Protection Association and the American Water Works Association.

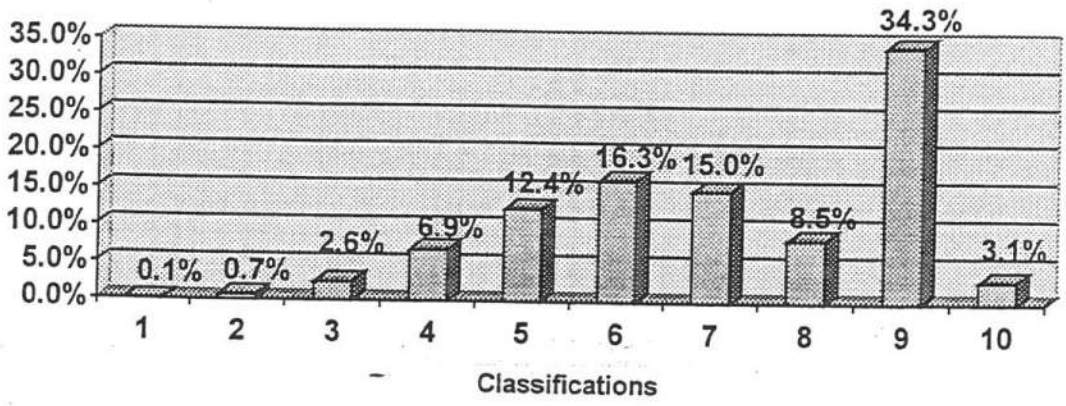
Using the FSRS, ISO objectively reviews the fire suppression capabilities of a community and assigns a Public Protection Classification – a number from 1 to 10. Class 1 represents exemplary fire protection, and Class 10 indicates that the area's fire suppression program does not meet minimum recognition criteria.

The FSRS allocates credit by evaluating the following three major features:

- Fire alarm and communication system. This review accounts for 10% of the total classification which centers upon a community's facilities and support for handling and dispatching fire alarms.
- Fire department. This review accounts for 50% of the total classification which focuses upon items such as engine companies, ladder or service companies, distribution of fire stations and fire companies, equipment carried on apparatus, pumping capacity, reserve apparatus, department manning, and training.
- Water supply system. This review accounts for 40% of the total classification highlighting the water supply a community uses for fire suppression, including hydrant size, type, and installation, as well as the inspection frequency and condition of fire hydrants.

When ISO develops a single classification for a community, all of the community's properties receive that classification. In many communities, ISO develops a split classification (for example, 5/9). Generally, the first class, (Class 5 in the example) applies to properties within a defined distance (5-road miles in most states) of a fire station and within 1000 feet of a fire hydrant. The second class (Class 9 in the example) applies to properties beyond 1000 feet of a hydrant but within the defined distance of a fire station. ISO generally assigns Class 10 to properties beyond the defined distance of a fire station.

Countrywide Public Protection Classification Summary



Grading Sheet For: Red Hook FPD, NY
Dutchess County

Public Protection Class: 4 / 9 Surveyed: August, 2002

Feature	Credit Assigned	Maximum Credit
Receiving and Handling Fire Alarms	9.66%	10.00%
Fire Department	25.51%	50.00%
Water Supply	38.39%	40.00%
*Divergence	-8.99%	
Total Credit	64.57%	100.00%

The Public Protection Class is based on the total percentage credit as follows:

Class	%
1	90.00 or more
2	80.00 to 89.99
3	70.00 to 79.99
4	60.00 to 69.99
5	50.00 to 59.99
6	40.00 to 49.99
7	30.00 to 39.99
8	20.00 to 29.99
9	10.00 to 19.99
10	0 to 9.99

*Divergence is a reduction in credit to reflect a difference in the relative credits for Fire Department and Water Supply.

The above classification has been developed for use in property insurance premium calculations.

CLASSIFICATION DETAILS

Graded Area: Red Hook FPD
County: Dutchess State: NY
Date Surveyed: August, 2002 Total Credit: 64.57 Class: 4 / 9 Pop.: 5000

RECEIVING AND HANDLING FIRE ALARMS

This section of the Fire Suppression Rating Schedule reviews the facilities provided for the general public to report fires, and for the operator on duty at the communication center to dispatch fire department companies to the fires.

	Credit	
	Actual	Maximum
1. Credit for Telephone Service (Item 414)		
This item reviews the facilities provided for the public to report fires, including the listing of fire and business numbers in the telephone directory.	1.66	2.00
2. Credit for Operators (Item 422)		
This item reviews the number of operators on-duty at the communication center to handle fire calls.	3.00	3.00
3. Credit for Dispatch Circuits (Item 432)		
This item reviews the dispatch circuit facilities used to transmit alarms to fire department members.	5.00	5.00
4. Total Credit for Receiving and Handling Fire Alarms:	9.66	10.00
Relative Classification for Receiving and Handling Fire Alarms:	1	

CLASSIFICATION DETAILS

Graded Area: Red Hook FPD
County: Dutchess State: NY
Date Surveyed: August, 2002 Total Credit: 64.57 Class: 4 / 9 Pop.: 5000

FIRE DEPARTMENT

This section of the Fire Suppression Rating Schedule reviews the engine and ladder-service companies, equipment carried, response to fires, training and available fire fighters.

	Credit	
	Actual	Maximum
1. Credit for Engine Companies (Item 513)		
This item reviews the number of engine companies and the hose equipment carried.	4.37	10.00
2. Credit for Reserve Pumpers (Item 523)		
This item reviews the number of reserve pumpers, their pump capacity and the hose equipment carried on each.	0.47	1.00
3. Credit for Pump Capacity (Item 532)		
This item reviews the total available pump capacity.	5.00	5.00
4. Credit for Ladder-Service Companies (Item 549)		
This item reviews the number of ladder and service companies and the equipment carried.	4.00	5.00
5. Credit for Reserve Ladder-Service Companies (Item 553)		
This item reviews the number of reserve ladder and service trucks, and the equipment carried.	0.21	1.00

Graded Area: Red Hook FPD
County: Dutchess State: NY
Date Surveyed: August, 2002 Total Credit: 64.57 Class: 4 / 9 Pop.: 5000

FIRE DEPARTMENT
(continued)

	Credit	
	Actual	Maximum
6. Credit for Distribution (Item 561)		
This item reviews the percent of the built-upon area of the city which has an adequately-equipped, responding first-due engine company within 1.5 miles and an adequately-equipped, responding ladder-service company within 2.5 miles.	0.39	4.00
7. Credit for Company Personnel (Item 571)		
This item reviews the average number of equivalent fire fighters and company officers on duty with existing companies.	8.64	15.00+
8. Credit for Training (Item 581)		
This item reviews the training facilities and their use.	2.43	9.00
9. Total Credit for Fire Department:	25.51	50.00+
Relative Classification for Fire Department:	5	

+ This indicates that credit for manning is open-ended, with no maximum credit for this item.

CLASSIFICATION DETAILS

Graded Area: Red Hook FPD
County: Dutchess State: NY
Date Surveyed: August, 2002 Total Credit: 64.57 Class: 4 / 9 Pop.: 5000

WATER SUPPLY

This section of the Fire Suppression Rating Schedule reviews the water supply system that is available for fire suppression in the city.

	Credit	
	Actual	Maximum
1. Credit for the Water System (Item 616)		
This item reviews the supply works, the main capacity and hydrant distribution.	35.00	35.00
2. Credit for Hydrants (Item 621)		
This item reviews the type of hydrants, and method of installation.	1.96	2.00
3. Credit for Inspection and Condition of Hydrants (Item 631)		
This item reviews the frequency of inspections of hydrants and their condition	1.43	3.00
4. Total Credit for Water Supply:	38.39	40.00
Relative Classification for Water Supply:	1	

PUBLIC PROTECTION CLASSIFICATION

IMPROVEMENT STATEMENTS
FOR
Red Hook FPD
Dutchess County, NY

Prepared by
INSURANCE SERVICES OFFICE, INC.
4B Eves Drive, Suite 200, Marlton, NJ 08053
800 444-4554 FAX 856 985-2511

The following statements are based upon the criteria contained in our Fire Suppression Rating Schedule and upon conditions in Red Hook FPD, NY during August, 2002. They indicate the performance needed to receive full credit for the specific item in the Schedule, and the quantity you have provided. Partial improvement will result in receiving a partial increase in the credit. These statements relate only to the fire insurance classification of your fire district. They are not for property loss prevention or life safety purposes and no life safety or property loss prevention recommendations are made.

RECEIVING AND HANDLING FIRE ALARMS

Credit For Telephone Service (Item 414).

Actual = 1.66%; Maximum = 2.00%

For maximum credit in the Schedule, there should be 6 incoming telephone lines reserved for receiving notification of fires (and other emergency calls). You have 5 lines reserved.

For maximum credit in the Schedule, there should be 3 incoming telephone lines for conducting other fire department business. You have 1 line in addition to the lines reserved for receiving notification of fires (and other emergency calls.)

For maximum credit in the Schedule, there should be 6 incoming lines reserved for notification of fires (and other emergency calls) plus 3 additional lines for conducting other fire department business. Since the designated business line is to a location that is not attended during normal business hours, 1(one) line has been deducted from the number of creditable reserved fire lines.

For maximum credit in the Schedule, both the number to report a fire and the fire department business number should be listed under "Fire Department" in the white pages directory (or government section of the white pages). Your fire number is listed but your business number is not listed under "Fire Department".

Total credit for Receiving and Handling Fire Alarms (Item 440)

Actual = 9.66%; Maximum = 10.00%

FIRE DEPARTMENT

Credit For Engine Companies (Item 513).

Actual = 4.37%; Maximum = 10.00%

For maximum credit in the Schedule, 2 engine companies are needed in your fire district.
These are calculated as follows:

1 for the Basic Fire Flow of 500 gpm.

1 additional for the size of the area served.

You have 1 engine company in service.
It is calculated as follows:

87 percent for Engine 58-12 because of insufficient equipment.
Additionally Engine 58-12 is lacking: a minimum of 400' of 2 in., 2½ in., or 3 in. hose carried, a minimum of 1200' of 2 in., 2½ in., 3 in. or larger hose carried.

Credit For Reserve Pumpers (Item 523).

Actual = 0.47%; Maximum = 1.00%

For maximum credit in the Schedule, 1 fully-equipped reserve pumper is needed. You have 1 reserve pumper.
This is calculated as follows:

93 percent for Engine 58-13 because of insufficient equipment.

Credit For Ladder Service (Item 549).

Actual = 4.00%; Maximum = 5.00%

For maximum credit in the Schedule, 1 service company is needed in your fire district.
This is calculated as follows:

1 service company due to method of operation.

You have 1 service company
This is calculated as follows:

79 percent for Service 58-55 because of insufficient equipment.

Credit For Reserve Ladder Service (Item 553).

Actual = 0.21%; Maximum = 1.00%

For maximum credit in the Schedule, 1 fully-equipped reserve service truck is needed.
You have 1 reserve service truck.
This is calculated as follows:

21 percent for Service 58-12 because of insufficient equipment.

Credit For Distribution (Item 561).

Actual = 0.39%; Maximum = 4.00%

For maximum credit in the Schedule, all sections of the fire district with hydrant protection should be within 1½ miles of a fully-equipped engine company and 2½ miles of a fully-equipped ladder, service, engine-ladder or engine-service company. The distance to be measured along all-weather roads.

Credit For Company Personnel (Item 571).

Actual = 8.64%; Maximum = 15.00%

An increase in the average response of fire department members by one person will increase the fire department credit by 0.56.

Credit For Training (Item 581).

Actual = 2.43%; Maximum = 9.00%

For maximum credit in the Schedule, the training program should be improved. You received 27 percent credit for the current training program and the use of facilities.

For maximum credit in the Schedule, pre-fire planning inspections of each commercial, industrial, institutional and other similar-type building should be made twice a year by company members. Records of the inspections should include complete and up-to-date notes and sketches.

For maximum credit in the Schedule, complete records should be kept of all training.

Total credit for Fire Department (Item 590)

Actual = 25.51%; Maximum = 50.00%

WATER SUPPLY

Credit For Hydrants (Item 621).

Actual = 1.96%; Maximum = 2.00%

For maximum credit in the Schedule, all hydrants should have a pumper outlet.

Credit For Inspection and Condition of Hydrants (Item 631).

Actual = 1.43%; Maximum = 3.00%

For maximum credit in the Schedule, all hydrants should be inspected twice a year, the inspection should include operation and a test at domestic pressure. Records should be kept of the inspections. Hydrants should be conspicuous, well located for use by a pumper, and in good condition.

Total credit for Water Supply (Item 640)

Actual = 38.39%; Maximum = 40.00%

INSURANCE SERVICES OFFICE, INC.

HYDRANT FLOW DATA SUMMARY

City Red Hook FPD
County Dutchess State NY Witnessed by Insurance Services Office, Inc. Date August 14, 2002

TEST NO.	TYPE DIST.*	TEST LOCATION	SERVICE	FLOW - GPM $Q=(29.83(C(d^2)p^{0.5}))$ INDIVIDUAL HYDRANTS			TOTAL	PRESSURE PSI STATIC	RESID.	FLOW -AT 20 PSI $Q_R=Q_F(h_R^{0.54}/h_F^{0.54})$ NEEDED **	AVAIL.	REMARKS
1	Res	Thayer Ave & Cornell Ave	Main	790			790	70	29	500	900	
2	Res	Harvard St & Columbia Ave	Main	780			780	70	28	750	850	
3	Res	Aspinwall Rd & Alder St	Main	710			710	70	30	750	800	
4	Res	Elm St n/o Aspinwall Rd	Main	290			290	82	75	500	950	
5	Res	North Dr & Manor Rd	Main	520			520	76	47	750	750	

THE ABOVE LISTED NEEDED FIRE FLOWS ARE FOR PROPERTY INSURANCE PREMIUM CALCULATIONS ONLY AND ARE *NOT* INTENDED TO PREDICT THE MAXIMUM AMOUNT OF WATER REQUIRED FOR A LARGE SCALE FIRE CONDITION. THE AVAILABLE FLOWS ONLY INDICATE THE CONDITIONS THAT EXISTED AT THE TIME AND AT THE LOCATION WHERE TESTS WERE WITNESSED.

*Comm = Commercial; Res = Residential.

**Needed is the rate of flow for a specific duration for a full credit condition. Needed Fire Flows greater than 3,500 gpm are not considered in determining the classification of the city when using the Fire Suppression Rating Schedule.

ISO COMMERCIAL RISK SERVICES, INC.

HYDRANT FLOW DATA SUMMARY

8/1/2002

City Red Hook V State NY Zip 12571 Witnessed by G.A. Kern Date May 20, 1991 & May 21, 1991
Red Hook TFPD

TEST NO.	TYPE DIST.*	TEST LOCATION	SERVICE	FLOW-GPM INDIVIDUAL HYDRANTS			FLOW-GPM TOTAL	PRESSURE PSI STATIC	PRESSURE PSI RESID.	FLOW AT 20 PSI NEEDED **	FLOW AT 20 PSI AVAIL.	REMARKS
1	Comm.	Thompson Street @ Fisk	Main	790			790	80	43	1500	1000	Village Water
2	Comm.	S. Broadway @ Amherst	Main	630			630	84	30	3000	700	Village Water
3	Comm.	East Market Street @ Broadway	Main	870			870	82	55	2500	1400	Village Water
4	Comm.	Benner Road @ Garden Street	Main	340			340	90	12	2250	300	Village Water
5	Comm.	Broadway @ Cherry Street	Main	750			750	82	70	1750	1800	Village Water
6	Res.	Linden @ Park Street	Main	240			240	84	43	1000	300	Village Water
		Town Water District										
1	Res.	Thayer @ Cornell Street	Main	920			920	104	32	1000	1000	
2	Res.	North Road @ Manor Road	Main	610			610	78	14	750	600	
3	Res.	Aspenwald @ Alder	Main	870			870	90	32	1000	950	
4	~~RES~~	HARVARD & COLUMBIA										
5												

THE ABOVE LISTED NEEDED FIRE FLOWS ARE FOR PROPERTY INSURANCE PREMIUM CALCULATIONS ONLY AND ARE *NOT* INTENDED TO PREDICT THE MAXIMUM AMOUNT OF WATER REQUIRED FOR A LARGE SCALE FIRE CONDITION. THE AVAILABLE FLOWS ONLY INDICATE THE CONDITIONS THAT EXISTED AT THE TIME AND AT THE LOCATION WHERE TESTS WERE WITNESSED.

* Comm = Commercial; Res = Residential.

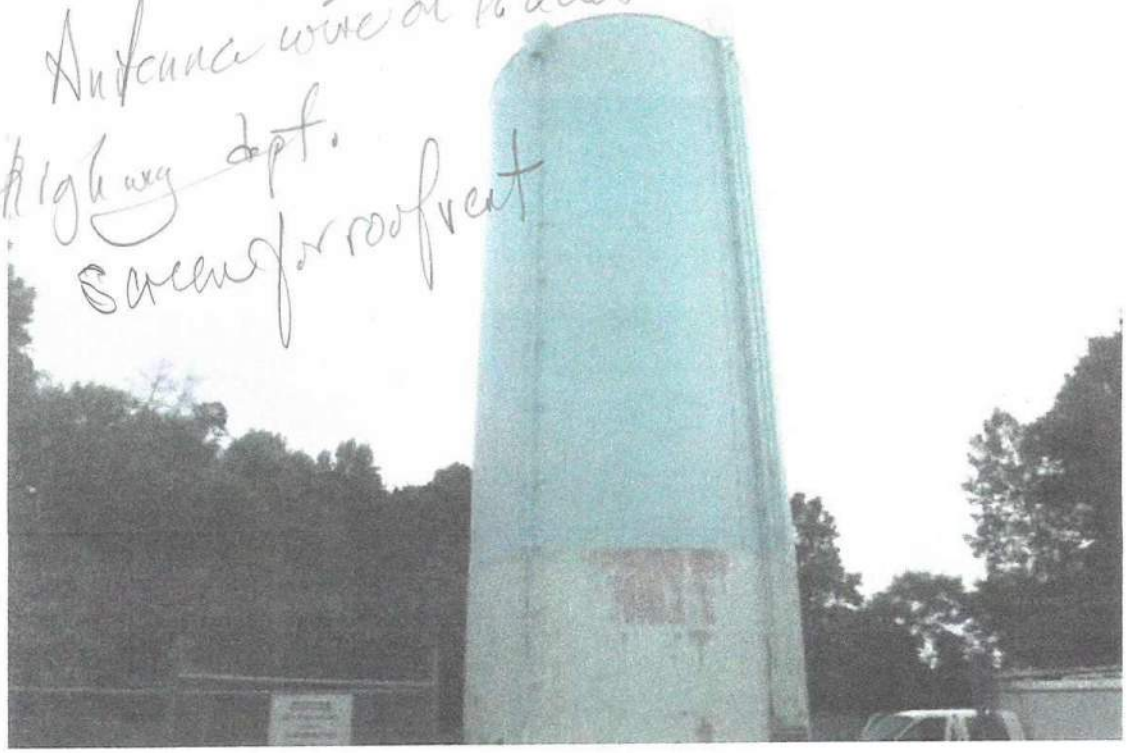
** Needed is the rate of flow for a specific duration for a full credit condition. Needed Fire Flows greater than 3,500 gpm are not considered in determining the classification of the city when using the Fire Suppression Rating Schedule.

APPENDIX D

PITTSBURG TANK & TOWER GROUP
MAINTENANCE DIVISION Since 1919

1 Watertank Place
PO Box 1849
Henderson, KY 42419
P: (270) 826-9000
F: (270) 767-6912
www.pttg.com

Note: Antenna wire on ladder
= highway dpt.
screen for roof vent



Town of Red Hook
7340 South Broadway
Red Hook, NY 12571
RE: Twin Tower Rd
900,000 Gallon STP
July 10, 2017
Mr. Hank Van Parys
Council Member
(845) 758-4608
Job No. 317370

If you would like to speak with Patrick Heltsley concerning this report, call (270) 826-9000, Ext.4601

For additional copies of this report call (270) 826-9000, Ext. 4601

PTTG Since 1919
MAINTENANCE DIVISION

Town of Red Hook
RE: Twin Tower Rd
900,000 Gallon STP

Photo shows the tank is secured with fencing. We recommend posting a **Warning, Tampering With This Facility is a Federal Offense** (US code title 42, section 300i-1) sign.

Photo shows the area around the tank foundation is properly graded and in compliance with AWWA D100-11; 12.7.1: Height aboveground.

PTTG Since 1919
MAINTENANCE DIVISION

Town of Red Hook
RE: Twin Tower Rd
900,000 Gallon STP

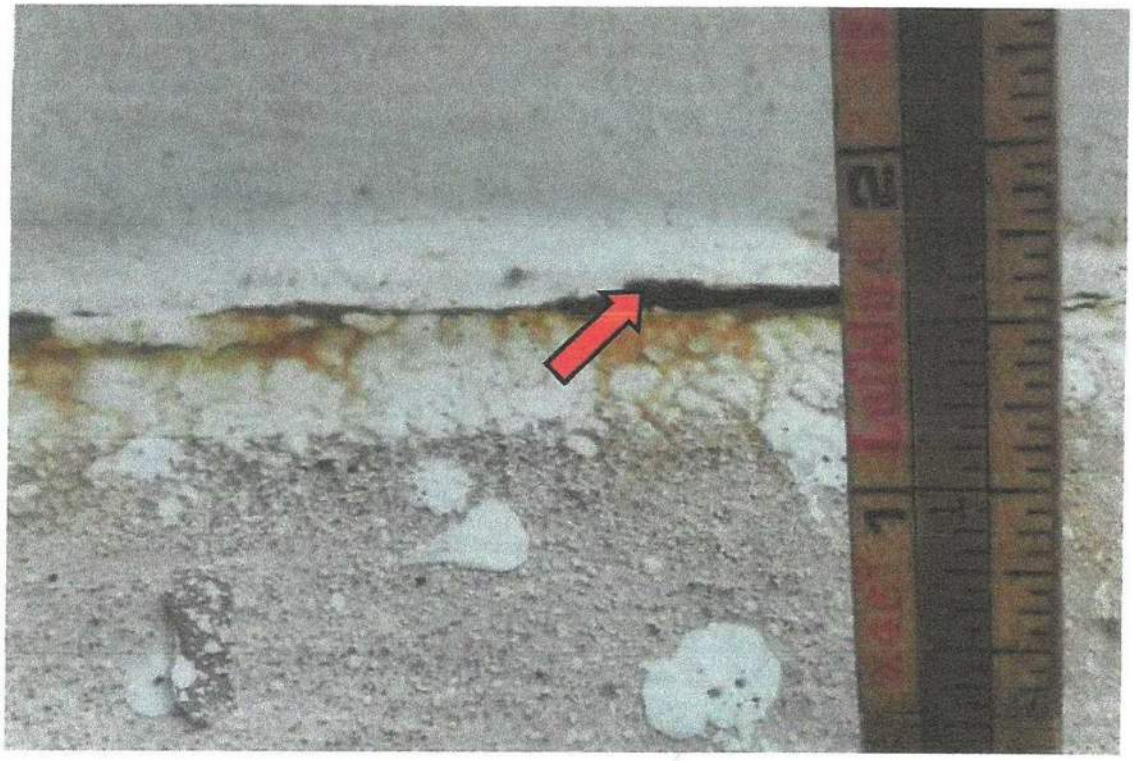


Photo shows the condition of the foundation. We recommend repairing any cracks and spalling in the concrete with a commercial non-shrinking grout, caulking around the base of the tank to foundation connection to prevent water from entering under the tank, then sealing the foundation with a sealant.

Photo shows the tank is electrically grounded for lightning protection as required by OSHA 29 CFR 1926 (K) and appears to be in good condition.

Photo shows the condition of the anchor bolts. AWWA D100-11; 3.8.1.1: Required Anchorage states, "For ground-supported flat-bottom reservoirs and standpipes, mechanical anchorage shall be provided when the wind or seismic loads exceed the limits for self-anchored tanks." We recommend cleaning the area around the anchor bolts, tightening the anchor nuts to specifications, then tack welding on the circumference of the nut-to-base plate connections and tack welding the bolt-to-nut connections for preventive maintenance.

Photo shows the condition of the shell. Currently there is no drain valve. We recommend installing a frost proof drain valve near the shell-to-floor connection, complete with a locking device to prevent unauthorized draining of the tank and a splash pad to direct water away from the foundation.

D

Photo shows the tank name plate.

PTTG Since 1919
MAINTENANCE DIVISION

Town of Red Hook
RE: Twin Tower Rd
900,000 Gallon STP

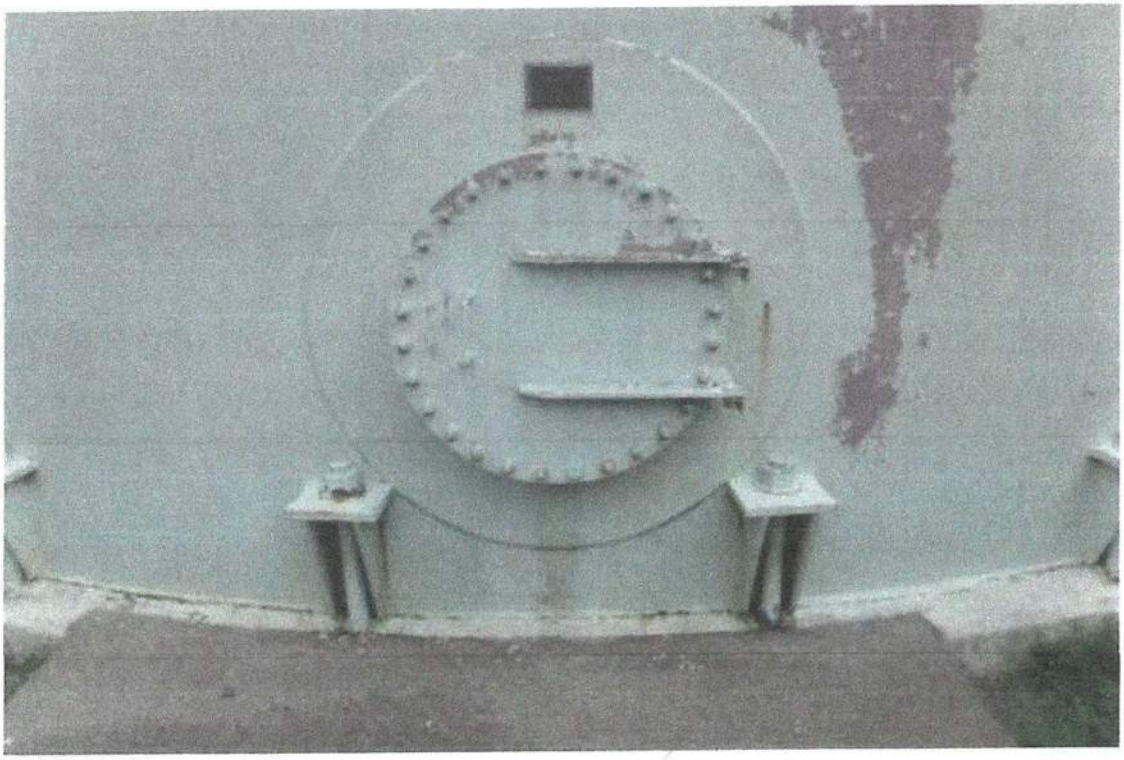


Photo shows the condition of the 30" primary shell manway. AWWA D100-11; 7.4.4: Shell manholes states, "Two shell manholes shall be provided in the first ring of the tank shell. At least one manhole shall be circular with a minimum diameter of 30" (760 mm)." The primary manway requires the following to be in compliance with AWWA D100-11; 7.4.4: Shell manholes and OSHA 1910.146 (c)(2) Confined spaces.

We recommend:

Post **Confined Space Entry** sign
Install maintenance free galvanized steel bolts

? No one will be entering

PTTG Since 1919
MAINTENANCE DIVISION

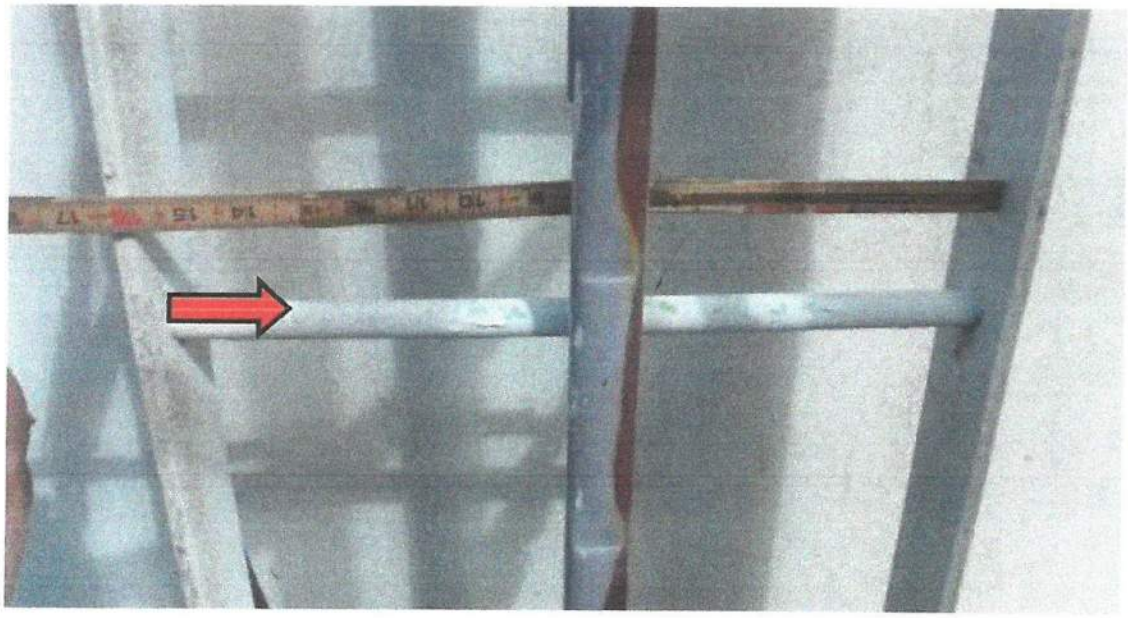
Town of Red Hook
RE: Twin Tower Rd
900,000 Gallon STP

Photo shows the condition of the 30" secondary shell manway. AWWA D100-11; 7.4.4: Shell manholes states, "Two shell manholes shall be provided in the first ring of the tank shell. At least one manhole shall be circular with a minimum diameter of 30" (760 mm)." The secondary manway requires the following to be in compliance with AWWA D100-11; 7.4.4: Shell manholes and OSHA 1910.146 (c)(2) Confined spaces.

We recommend:

Post **Confined Space Entry** sign
Install maintenance free galvanized steel bolts

Photos show the overflow pipe system, which is not equipped with a flapper valve as required by AWWA D100-11; 7.3: Overflow. We recommend installing a flapper valve and new screen on the existing overflow pipe.



Shell access ladder in above photos is 16" wide, but is not equipped with anti-skid rungs. **Notice the condition of the safety climb.** OSHA 1926.1053 Ladders states, "Rungs must be corrugated, knurled, dimpled, coated with skid-resistant material or treated to minimize slipping." We recommend installing anti-skid rung covers, replacing the existing safety climb with a cable type ladder safety device, and posting a **Fall Protection Required** sign at the base of the ladder.

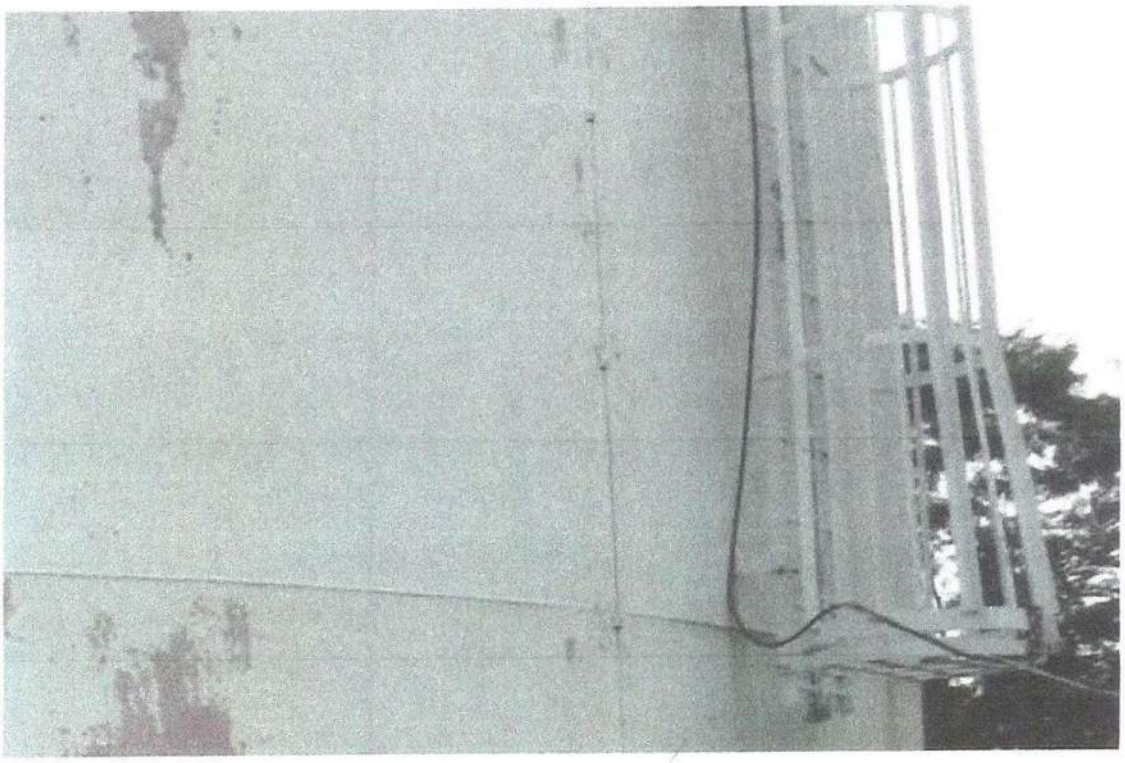


Photo shows more of the condition of the existing shell access ladder. Safe climbing procedure requires a person to climb a ladder with their hands on the side rails of the ladder and not the ladder rungs. **Notice a co/ax is mounted on the ladder side rail, creating a climbing safety hazard.** We recommend removing the co/ax from the ladder, and securing it with standoffs to the tank shell to eliminate this climbing safety hazard.

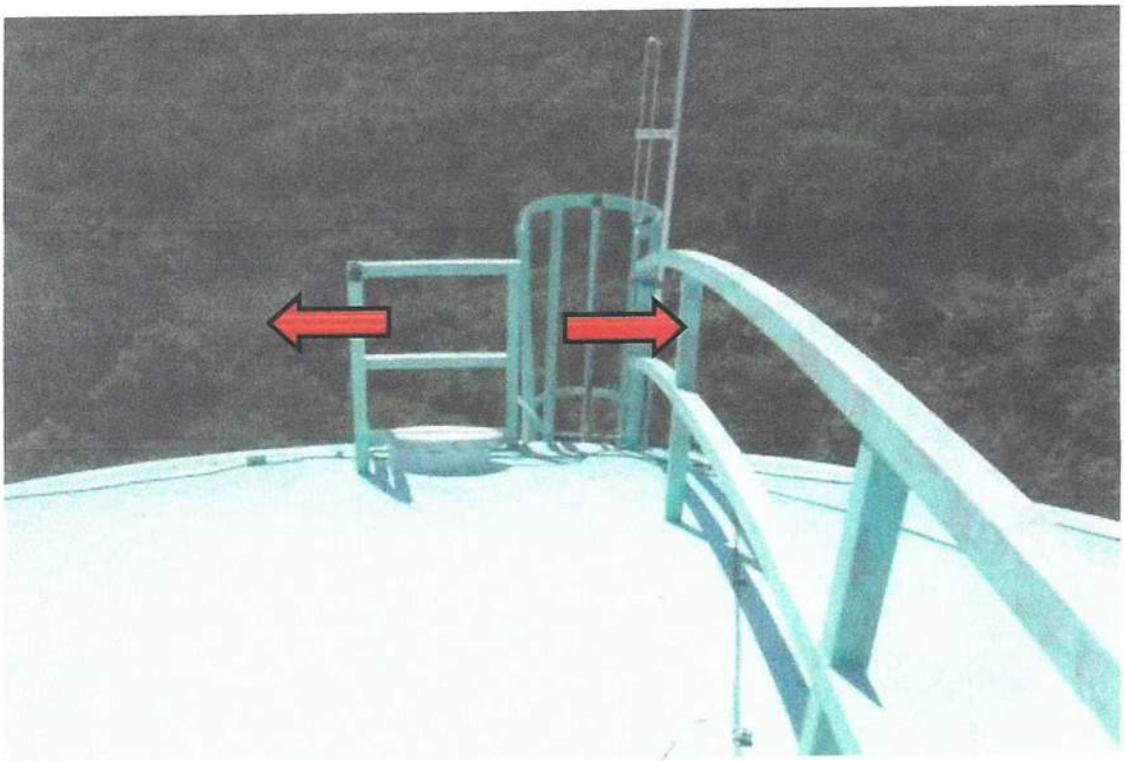


Photo shows the tank roof edge is not equipped with a required handrail system for fall protection. OSHA 1910.23 (c)(1) states, "Every open-sided floor or platform 4 feet or more above adjacent floor or ground level shall be guarded by a standard railing… on all open sides." The tank is equipped with 42" high handrails to the left and right of the access ladder. We recommend extending the handrails around the circumference of the tank roof, complete with an intermediate rail, a toeboard, and a swing gate at the junction of the shell-to-roof access ladder and tank roof.

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Town of Red Hook
RE: Twin Tower Rd
900,000 Gallon STP

Photo shows the condition of the 24" primary roof manway. Roof openings on this tank require the following to be in compliance with AWWA D100-11, 7.4.3: Roof openings and OSHA 1910.146 (c)(2) Confined spaces.

We recommend:

Post **Confined Space Entry** sign
Install new lock on existing manway — done?

Need 30" manway?

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MAINTENANCE DIVISION

Town of Red Hook
RE: Twin Tower Rd
900,000 Gallon STP

Photo shows the condition of the 24" secondary roof manway. Roof openings on this tank require the following to be in compliance with AWWA D100-11, 7.4.3: Roof openings and OSHA 1910.146 (c)(2) Confined spaces.

We recommend:

Replace 24" roof manway with a 30" manway
Post **Confined Space Entry** sign
Install new lock on existing manway

also trade for primary manway?

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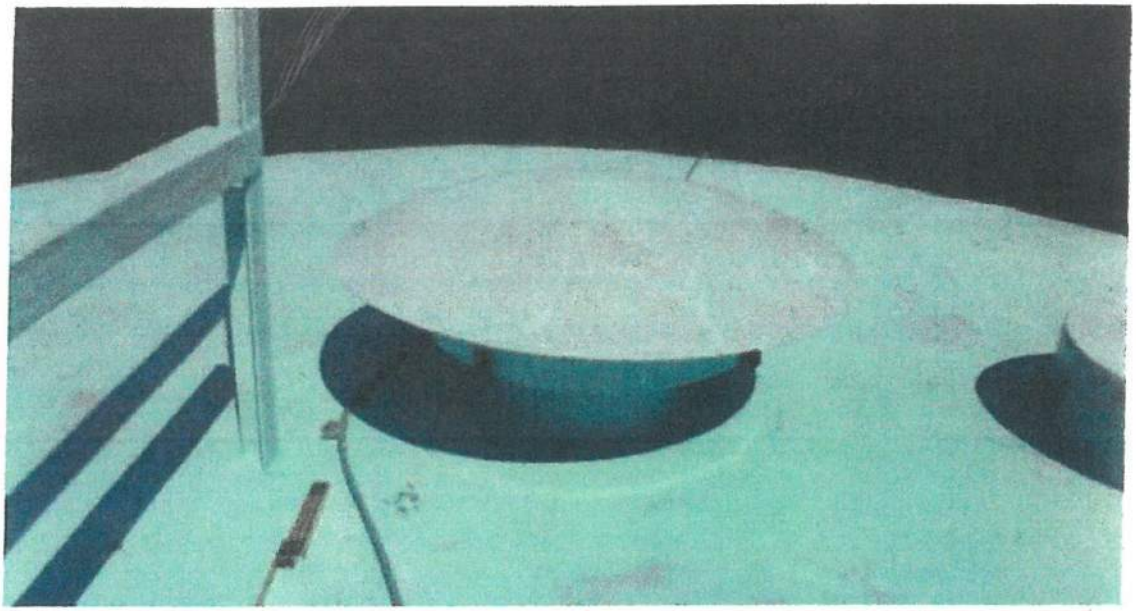
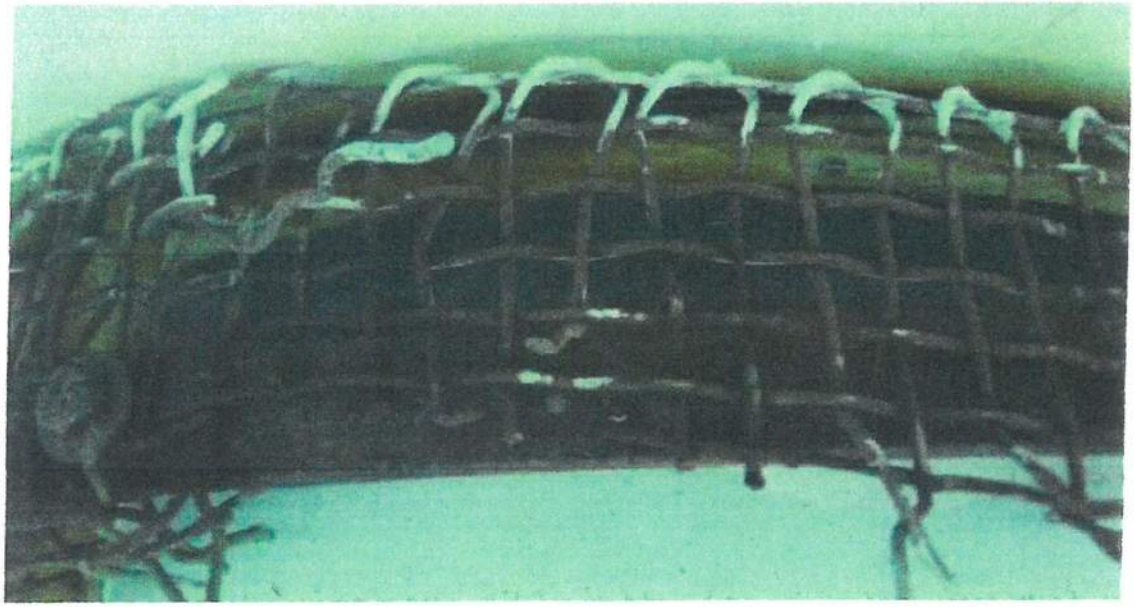
Town of Red Hook
RE: Twin Tower Rd
900,000 Gallon STP





Photos show the condition of the existing 14" roof vent. This vent is allowing the ingress of rain and wind-borne contaminants into the water system. **An improperly vented tank may cause external pressure to act on the tank which can cause buckling even at low pressure differential.** We recommend replacing the existing roof vent with a vacuum-pressure, frost proof vent and screen.

This work should be performed on an emergency basis.

Not noted in previous inspections, New requirement?

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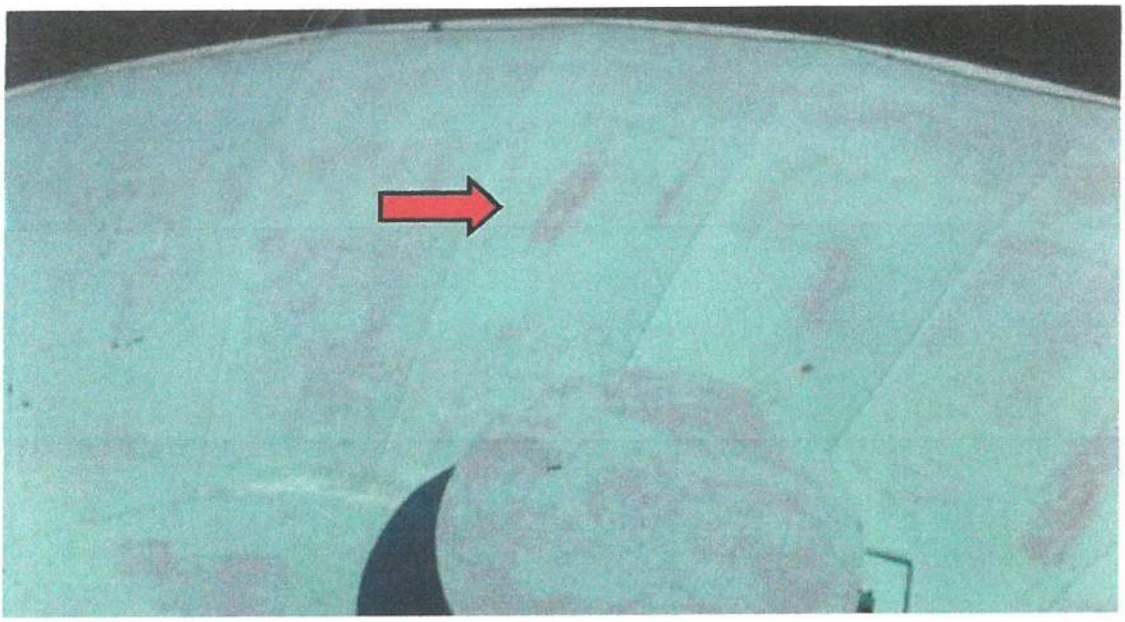
Town of Red Hook
RE: Twin Tower Rd
900,000 Gallon STP



Photos show the tank exterior coating system. We recommend pressure washing the tank exterior with biodegradable detergent injection (minimum 3,500 psi at 3.0 gpm) then removing all loose rust and scale with wire brushes and hand scrapers in accordance with SSPC#2 (hand tool cleaning), spot priming and applying one (1) finish coat of acrylic paint.

wait for total cleaning/painting or replacement

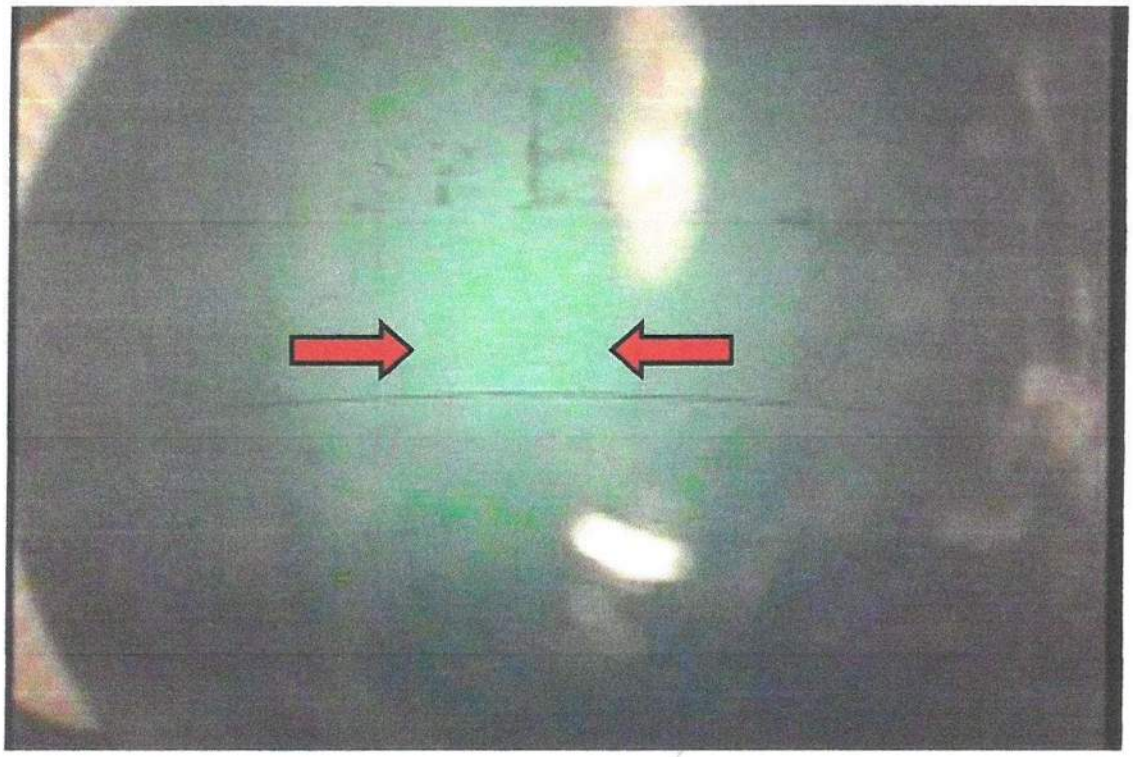


Photo shows tank is not equipped with interior access ladders. AWWA 7.4.2.4: Inside tank ladder states, "When specified, an inside tank ladder shall be provided for access from the roof to the bottom of the tank." We recommend installing OSHA compliant interior access ladders complete with standoffs every 10' on center and anti-skid rungs, and cable type ladder safety devices at the primary and secondary roof manways.

*In cold climates it's up to the owner's discretion on placement of internal ladders.

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RE: Twin Tower Rd
900,000 Gallon STP

Photo shows a fill pipe on the tank interior. A temperature difference between the water in the top and bottom of a tank, even as little as 1-2 degrees Fahrenheit, is an indication of thermal stratification and the tank water not being completely mixed. Incomplete mixing would result in short-circuiting, and localized increase in water age would develop inside the tank. This typically leads to water quality problems, such as loss of residual, DBP spikes, HPC spikes, bacteria regrowth, formation of bio-film, changes in pH and dissolved oxygen. We recommend installing a mixing system.

* [

On right tank

* we have had none of these problems

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Town of Red Hook
RE: Twin Tower Rd
900,000 Gallon STP

??

Not clear

Photo shows sediment and debris in the tank. We recommend performing an interior cleanout in order to prevent contamination issues associated with excessive sediment buildup.

how much?

This work should be performed on an emergency basis.

??

**Please note price for interior cleanout is based on removing 1" – 3" of sediment. Any additional accumulation discovered will be priced on site. In the event the tank has to be drained, tank will need to be drained by the owner, prior to our arrival.*

We further recommend installing a passive cathodic protection system.

- tank cleaned in 2010
- amt of sediment then was only 3-5" after 20 yr.; 12 yr w/o/ittons

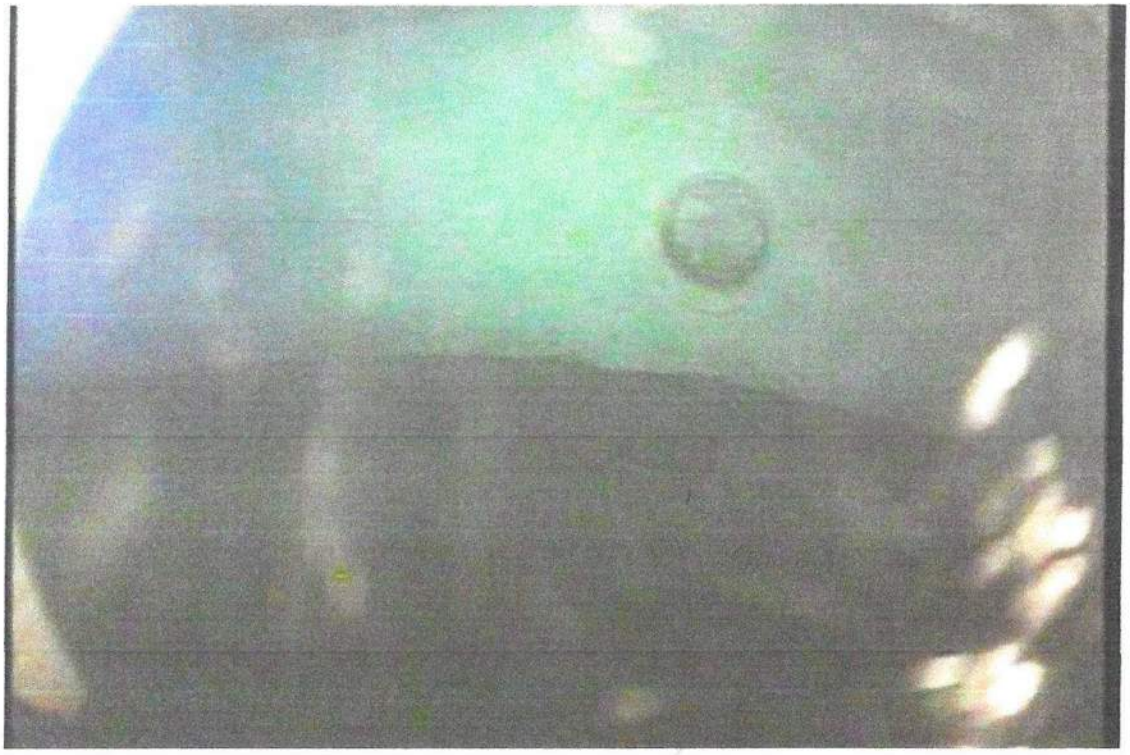

Photo shows the condition of the tank floor. After performing the interior cleanout, if buckling is present we recommend stabilizing the floor by pumping grout to the underneath side of the floor where the buckling is occurring. This will be done by installing couplings in the tank floor, pumping grout at 15# psi, filling the voided areas to prevent any further buckling, then vacuum testing the floor. Any defective seams will be repaired by welding.

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Town of Red Hook
RE: Twin Tower Rd
900,000 Gallon STP

Photos show the condition of the interior coating system. We recommend sand-blasting all rusted and abraded interior areas to SSPC-SP10 (near white), and brush blasting all remaining interior areas to SSPC-SP7; then applying one (1) spot coat of epoxy primer to all areas sandblasted to #10, stripe coating all weld seams, and applying one (1) full coat of epoxy to the entire tank, to achieve 8 to 10 mils of total dry film thickness. Total mil thickness will include a combination of the existing and new coating.

PITTSBURG TANK & TOWER GROUP
MAINTENANCE DIVISION Since 1919

1 Watertank Place
PO Box 1849
Henderson, KY 42419
P: (270) 826-9000
F: (270) 767-6912
www.pttg.com

STANDPIPE INSPECTION REPORT

JOB NO: 317370 INSPECTOR: Wade Lingerfelt (CE)

TANK OWNER: Town of Red Hook

OWNER'S REPRESENTATIVE: Mr. Hank Van Parys

TITLE: Council Member

MAILING ADDRESS: 7340 South Broadway Red Hook, NY 12571

PHYSICAL ADDRESS: 7340 South Broadway Red Hook, NY 12571

E-MAIL: clittle@redhook.org

CITY, STATE: Red Hook, NY ZIP: 12571 COUNTY: Duchess County

TELEPHONE: (845) 758-4608 FAX: (845) 758-5313

LOCATION OF TANK: Twin Tower Rd, Red Hook, NY 12571

Town of Red Hook
7340 South Broadway
Red Hook, NY 12571
July 10, 2017
Mr. Hank Van Parys
Council Member
(845) 758-4608

ORIGINAL CONTRACT NO: 4443 YEAR BUILT: 1989

ORIGINAL MANUFACTURER: Fisher Tank Company CAPACITY: 900,000 Gallon

DATE OF LAST INSPECTION: Not Provided TYPE: Potable

DIAMETER: 40'-0" HEIGHT: 98'-6"

OVERFLOW: 8" INLET: 20"

TYPE CONSTRUCTION: WELDED: X RIVETED: BOLTED:

ACCOUNT EXECUTIVE: P. Heltsley/L. Risley

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Mil Thickness								
Roof:	6.8	9.8	7.8	7.8	8.5	6.9	6.9	5.0
	6.7	7.9	5.7	6.2	6.1	5.8		
Ring 8:	7.8	8.9						
Ring 7:	6.4	6.5						
Ring 6:	6.4	7.3						
Ring 5:	6.9	7.3						
Ring 4:	6.9	7.3						
Ring 3:	6.7	7.2						
Ring 2:	7.4	8.2						
Ring 1:	14.2	15.3	18.9	19.2	18.7	18.9	19.7	16.2
	14.9	12.1	13.8	15.6	17.5	13.6	14.7	14.7

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UT Thickness								
Roof:	0.219	0.216	0.223	0.219	0.219	0.225	0.221	0.222
	0.219	0.220						
Ring 7:	0.235	0.215						
Ring 6:	0.239	0.212						
Ring 5:	0.231	0.215						
Ring 4:	0.219	0.222						
Ring 3:	0.214	0.223						
Ring 2:	0.212	0.223						
Ring 1:	0.425	0.411	0.414	0.432	0.431	0.415	0.452	0.431
	0.415	0.414						

Phone: 877.821.6138 | office@underwatersolutionsinc.com
Your National Water Infrastructure Specialists

Report Date: 3/21/2022

Account Overview

Account Name: Town of Red Hook Water District
Asset Name: 900TG Tank
Type of Tank: Finished Water
98'H X 40'D
Services: Clean (Sediment Removal)|Inspection
Tank Identification Plate:

Report Review & Approval

Report Approved By:

David Cornish, President

EXTERIOR PERIMETER OF TANK

Is this structure located within a guarded facility? **No**

GUARDED FACILITY DETAILS	
Does this structure have a fence that spans its circumference?	Yes
What is the height of the fence? (In Inches)	100
Does this fence have barbed wire?	Yes
Condition of the barbed wire	Good condition
What is the overall condition of the fence?	Good
Are they any deficiencies throughout the fence?	No
Are there any signs of forced entry / vandalism?	No
Is access gate functional and secured with a lock?	No

Security Photos

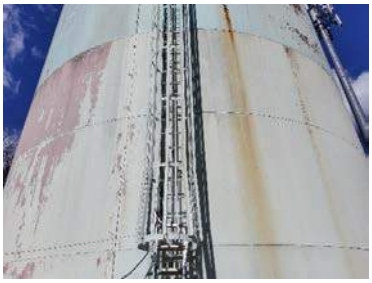
EXTERIOR WALL/SHELL

EXTERIOR WALL AESTHETICS

NORTH WALL	
Aesthetics	Mildew
Condition of Protective Coating	Decline/Thinning

North Wall Exterior Aesthetics Photos






SOUTH WALL	
Aesthetics	Graffiti|Mildew
Condition of Protective Coating	Decline/Thinning|Peeling

South Wall Exterior Aesthetics Photos




EAST WALL	
Aesthetics	Mildew
Condition of Protective Coating	Decline/Thinning

East Wall Exterior Aesthetics Photos




WEST WALL	
Aesthetics	Graffiti|Mildew
Condition of Protective Coating	Decline/Thinning|Peeling|Delaminating

West Wall Exterior Aesthetics Photos




EXTERIOR WALL STRUCTURAL

UPPER SECTION NORTH WALL	
Is there any sign of exposed steel in this section?	No

MIDDLE SECTION NORTH WALL	
Is there any sign of exposed steel in this section?	Yes
Percent (%) of exposed steel in this section	Less than 5%
Is there any sign of corrosion in this section?	No
Is there any sign of pitting in this section?	No

Exterior Middle North Wall Section - Photo of exposed steel

LOWER SECTION NORTH WALL	
Is there any sign of exposed steel in this section?	No

Overall photo of entire quadrant

UPPER SECTION SOUTH WALL	
Is there any sign of exposed steel in this section?	No

MIDDLE SECTION SOUTH WALL	
Is there any sign of exposed steel in this section?	No

LOWER SECTION SOUTH WALL	
Is there any sign of exposed steel in this section?	No

Overall photo of entire quadrant

UPPER SECTION EAST WALL	
Is there any sign of exposed steel?	No

MIDDLE SECTION EAST WALL	
Is there any sign of exposed steel?	No

LOWER SECTION EAST WALL	
Is there any sign of exposed steel?	No

Overall photo of entire quadrant

UPPER SECTION WEST WALL	
Is there any sign of exposed steel?	No

MIDDLE SECTION WEST WALL	
Is there any sign of exposed steel?	No

LOWER SECTION WEST WALL	
Is there any sign of exposed steel?	No

Overall photo of entire quadrant

EXTERIOR WALL WELDS

UPPER SECTION NORTH WALL	
Do all the welds in this section appear to be sound, free of fatigue /failure?	Yes
Does there appear to be any sign of leakage?	No

Upper North Wall Section- Photo of welds

MIDDLE SECTION NORTH WALL	
Do all the welds in this section appear to be sound, free of fatigue /failure?	Yes
Does there appear to be any sign of leakage?	No

Middle North Wall Section- Photo of welds

LOWER SECTION NORTH WALL	
Do all the welds in this section appear to be sound, free of fatigue /failure?	Yes
Does there appear to be any sign of leakage?	No

Lower North Wall Section- Photo of welds

UPPER SECTION SOUTH WALL	
Do all the welds in this section appear to be sound, free of fatigue /failure?	Yes
Does there appear to be any sign of leakage?	No

Upper South Wall Section- Photo of welds

MIDDLE SECTION SOUTH WALL	
Do all the welds in this section appear to be sound, free of fatigue /failure?	Yes
Does there appear to be any sign of leakage?	No

Middle South Wall Section- Photo of welds

LOWER SECTION SOUTH WALL	
Do all the welds in this section appear to be sound, free of fatigue /failure?	Yes
Does there appear to be any sign of leakage?	No

Lower South Wall Section- Photo of welds

UPPER SECTION EAST WALL	
Do all the welds in this section appear to be sound, free of fatigue /failure?	Yes
Does there appear to be any sign of leakage?	No

Upper East Wall Section- Photo of welds

MIDDLE SECTION EAST WALL	
Do all the welds in this section appear to be sound, free of fatigue /failure?	Yes
Does there appear to be any sign of leakage?	No

Middle East Wall Section- Photo of welds

LOWER SECTION EAST WALL	
Do all the welds in this section appear to be sound, free of fatigue /failure?	Yes
Does there appear to be any sign of leakage?	No

Lower East Wall Section- Photo of welds

UPPER SECTION WEST WALL	
Do all the welds in this section appear to be sound, free of fatigue /failure?	Yes
Does there appear to be any sign of leakage?	No

Upper West Wall Section- Photo of welds

MIDDLE SECTION WEST WALL	
Do all the welds in this section appear to be sound, free of fatigue /failure?	Yes
Does there appear to be any sign of leakage?	No

Middle West Wall Section- Photo of welds

LOWER SECTION WEST WALL	
Do all the welds in this section appear to be sound, free of fatigue /failure?	Yes
Does there appear to be any sign of leakage?	No

Lower West Wall Section- Photo of welds

CATWALK	
Does this structure have a catwalk?	No

GROUND LEVEL ULTRA SONIC / DRY FILM THICKNESS MEASUREMENTS

EXTERIOR NORTH WALL	
Ultra Sonic Thickness Measurements (In Inches) Panel #1	.380, .410, .399, .390
Ultra Sonic Thickness Measurements (In Inches) Panel #2	.383, .388, .379, .377
Dry Film Thickness Measurements (In Mils) Panel #1	9.1, 7.8, 8.5, 8.9
Dry Film Thickness Measurements (In Mils) Panel #2	8.3, 9.6, 8.7, 9.0

EXTERIOR EAST WALL	
Ultra Sonic Thickness Measurements (In Inches) Panel #1	.411, .413, .398, .390
Ultra Sonic Thickness Measurements (In Inches) Panel #2	.399, .390, .388, .397
Dry Film Thickness Measurements (In Mils) Panel #1	9.0, 9.3, 9.1, 8.9
Dry Film Thickness Measurements (In Mils) Panel #2	8.2, 8.9, 9.3, 10.1

EXTERIOR SOUTH WALL	
Ultra Sonic Thickness Measurements (In Inches) Panel #1	.434, .410, .400, .398
Ultra Sonic Thickness Measurements (In Inches) Panel #2	.378, .388, .382, .380
Dry Film Thickness Measurements (In Mils) Panel #1	9.0, 10.3, 8.1, 11.9
Dry Film Thickness Measurements (In Mils) Panel #2	8.5, 9.4, 7.9, 9.9

EXTERIOR WEST WALL	
Ultra Sonic Thickness Measurements (In Inches) Panel #1	.445, .419, .432, .402
Ultra Sonic Thickness Measurements (In Inches) Panel #2	.388, .397, .390, .378
Dry Film Thickness Measurements (In Mils) Panel #1	10.3, 11.0, 8.9, 9.5
Dry Film Thickness Measurements (In Mils) Panel #2	9.2,7.8, 8.9, 10.1

UPPER ELEVATIONS - ULTRA SONIC / Dry Film Thickness Measurements (In Mils)	
What wall are you completing these measurements on?	North
How many additional panels will you be measuring?	6

Panel #3	
Ultra Sonic Thickness Measurements (In Inches) Panel #3	.358, .369, .366, 371
Dry Film Thickness Measurements (In Mils) Panel #3	9.1, 8.0, 9.8, 7.1

Panel #4	
Ultra Sonic Thickness Measurements (In Inches) Panel #4	.362, .360, .344, .371
Dry Film Thickness Measurements (In Mils) Panel #4	6.6, 7.8, 9.1, 6.4

Panel #5	
Ultra Sonic Thickness Measurements (In Inches) Panel #5	.314, .299, .300, .287
Dry Film Thickness Measurements (In Mils) Panel #5	5.2 , 6.9, 7.8, 8.1

Panel #6	
Ultra Sonic Thickness Measurements (In Inches) Panel #6	.314, .300, .288, .291
Dry Film Thickness Measurements (In Mils) Panel #6	5.2 6.2 8.5 6.8

Panel #7	
Ultra Sonic Thickness Measurements (In Inches) Panel #7	. 297, .298, .278, .288
Dry Film Thickness Measurements (In Mils) Panel #7	7.3 6.2 7.8 9.4

Panel #8	
Ultra Sonic Thickness Measurements (In Inches) Panel #8	.281, .291, .278, .301
Dry Film Thickness Measurements (In Mils) Panel #8	7.2 9.3 7.8 8.1

EXTERIOR COMPONENTS

EXTERIOR MANWAYS	
How many exterior manways does this structure have?	1

EXTERIOR MANWAY #1	
Location #1	Southwest
Location #2	Wall
Shape	Circle
Diameter (in inches)	32
Height above the ground (in inches)	22
Is this manway secure?	Yes
Is there any sign of leakage?	No
Is this manway coated?	Yes
Condition of coating	Peeling
Is there any signs of metal exposure?	No
Is there any sign of corrosion?	No
Is there any sign of fatigue/pitting?	No
Dry Film Thickness Measurements (In Mils)	12.2 10.7 5.4 8.9
Ultra Sonic Thickness Measurements (In Inches)	1.069,1.075 , 1.075 , 1.066
What is the condition of the gasket?	Good

Exterior Manway 1 Photos

EXTERIOR PIPING	
Does this structure have any visible exterior pipes?	No

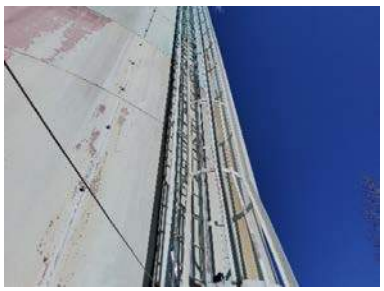
EXTERIOR AERATOR	
Does this structure have a rooftop aerator?	No

EXTERIOR LADDER ACCESSIBILITY AND COMPLIANCE	
Does this structure have an exterior ladder	Yes
Exterior Ladder Location #1	North
Exterior Ladder Location #2	Wall
What material is this ladder?	Steel
What is the width between side rails? (In Inches)	16
Rung Rise on center? (In Inches)	12
What is the ladder distance off wall? (In Inches)	8
How far is this ladder off the ground? (In Inches)	90
How many standoffs does this ladder have?	15
Do all welded connections seem sound?	Yes
Is this ladder coated?	Yes
Condition of coating?	Decline/Thinning

EXTERIOR LADDER SECURITY AND FALL PREVENTION	
Does this ladder have a fall prevention device?	Yes
What type of fall prevention device is available?	Notched Tube
What is the condition of this fall prevention device?	Good
Does this ladder have a safety cage?	Yes
What is the condition of the safety cage?	Good
Does this ladder have a ladder guard?	Yes
Is this ladder guard locked?	No

Exterior Ladder Photos



EXPOSED FOUNDATION	
Does this structure have an exposed foundation?	Yes
What is the height of this foundation? (In Inches)	8
What is the width of this foundation? (In Inches)	12
What is the condition of the concrete?	Concrete base slab was found to be in good condition at this time. Concrete was found to be coated with approximately 50% of all surfaces having coating failure. Less than 5% of all surfaces has shrinkage cracks with no substantial depth or width at thus time.

Exposed Foundation Photos









ANCHOR BOLTS	
Does this structure have anchor bolts?	Yes
How many?	32
What is the approximate height of the anchor bolts? (In Inches)	12
What is the approximate diameter of the anchor bolts? (In Inches)	2
Is the anchor bolts coated?	Yes
Condition of coating	Decline/Thinning
Is all hardware present?	Yes

EXTERIOR ROOF/SHELL

EXTERIOR ROOF AESTHETICS

NORTH ROOF QUADRANT AESTHETICS	
Aesthetic Deficiencies	No Visible Deficiencies
Condition of Protective Coating	Decline/Thinning

North Roof Quadrant Aesthetic Photos




SOUTH ROOF QUADRANT AESTHETICS	
Aesthetic Deficiencies	No Visible Deficiencies
Condition of Protective Coating	Decline/Thinning

South Roof Quadrant Aesthetic Photos



EAST ROOF QUADRANT AESTHETICS	
Aesthetic Deficiencies	No Visible Deficiencies
Condition of Protective Coating	Decline/Thinning

East Roof Quadrant Aesthetics Photos




WEST ROOF QUADRANT AESTHETICS	
Aesthetic Deficiencies	No Visible Deficiencies
Condition of Protective Coating	Decline/Thinning

West Roof Quadrant Aesthetics Photos


EXTERIOR ROOF STRUCTURAL

NORTH ROOF STRUCTURAL	
Is there any sign of exposed steel?	Yes
Percent (%) of exposed steel in this quadrant	Less than 5%
Is there any sign of corrosion?	No
Is there any sign of pitting?	No
Are all penetrations sealed?	Yes
Ultra Sonic Thickness Measurements (In Inches)	.302 .311 .338 .325
Dry Film Thickness Measurements (In Mils)	6.4 6.8 5.28 7.2
Do all the welds in this section appear to be sound, free of fatigue /failure?	Yes
Does there appear to be any sign of leakage?	No

Overall photo of this quadrant

Photo of exposed steel

North Quadrant- Photo of welds

SOUTH ROOF STRUCTURAL	
Is there any sign of exposed steel?	Yes
Percent (%) of exposed steel in this quadrant	Less than 5%
Is there any sign of corrosion?	No
Is there any sign of pitting?	No
Are all penetrations sealed?	Yes
Ultra Sonic Thickness Measurements (In Inches)	.322 .310 .304 .316
Dry Film Thickness Measurements (In Mils)	4.29 5.39 6.2 5.31
Do all the welds in this section appear to be sound, free of fatigue /failure?	Yes
Does there appear to be any sign of leakage?	No

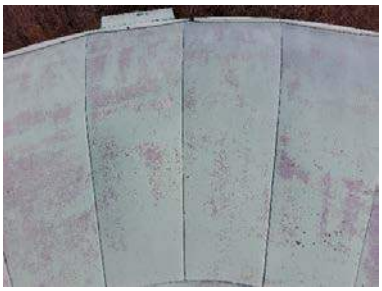
Overall photo of this quadrant

Photo of exposed steel

South Quadrant- Photo of welds

EAST ROOF STRUCTURAL	
Is there any sign of exposed steel?	No
Are all penetrations sealed?	Yes
Ultra Sonic Thickness Measurements (In Inches)	.302 .311 .338 .325
Dry Film Thickness Measurements (In Mils)	6.4 6.8 5.28 7.2
Do all the welds in this section appear to be sound, free of fatigue /failure?	Yes
Does there appear to be any sign of leakage?	No

Overall photo of this quadrant



East Quadrant- Photo of welds

WEST ROOF STRUCTURAL	
Is there any sign of exposed steel?	No
Are all penetrations sealed?	Yes
Ultra Sonic Thickness Measurements (In Inches)	.339 .314 .311 .315
Dry Film Thickness Measurements (In Mils)	8.8 10.2 5.34 6.6
Do all the welds in this section appear to be sound, free of fatigue /failure?	Yes
Does there appear to be any sign of leakage?	No

Overall photo of this quadrant

West Quadrant- Photo of welds

EXTERIOR COMPONENTS

EXTERIOR OVERFLOW	
How many overflows does this structure have?	1

OVERFLOW #1	
Location #1	East
Location #2	Wall
Where does this overflow terminate?	Into drain
How many inches above the ground does it terminate?	24
Does this overflow extend away from the structure?	No
Is this overflow free of obstructions?	Yes
Is there a screen present?	Yes
What size mesh is this screen?	18
Is this screen secure?	Yes
Does this screen have any deficiencies?	No
Is this overflow protected from wind driven rain?	No

Overflow #1 Photo

EXTERIOR VENT	
How many vents does this structure have?	1

VENT #1	
Location #1	Center
Location #2	Roof
Is this vent coated?	Yes
What is the condition of the coating?	Decline/Thinning
Is this vent downturned?	No
Is there a solid cover down to the bottom of the screen?	No
Is there a screen present?	Yes
What size screen is present? (in inches)	4

Vent 1 Photos

HATCH

EXTERIOR HATCH	
How many hatches does this structure have?	2

HATCH #1	
Location #1	North
Location #2	Roof
Shape	Circle
Diameter (in inches)	20
Is this hatch raised at least 4" above the roof?	Yes
Does this hatch have an overlapping water tight lid?	Yes
Does this lid have a gasket?	No
Was this hatch opened during inspection?	Yes
Did this hatch function properly?	Yes
Is this hatch secured with a lock?	No
Is this hatch coated?	Yes
Condition of coating on exterior	Decline/Thinning

Hatch Photos

HATCH #2	
Location #1	Center
Location #2	Roof
Shape	Circle
Diameter (in inches)	24
Is this hatch raised at least 4" above the roof?	Yes
Does this hatch have an overlapping water tight lid?	Yes
Does this lid have a gasket?	No
Was this hatch opened during inspection?	Yes
Did this hatch function properly?	Yes
Is this hatch secured with a lock?	No
Is this hatch coated?	Yes
Condition of coating on exterior	Decline/Thinning

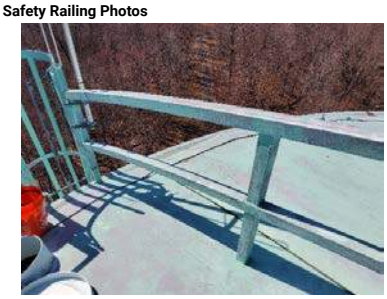
Hatch #2 Photos

SAFETY RAILINGS

EXTERIOR SAFETY RAILINGS	
Does this structure have safety railings?	Yes

What is the material of the safety railings?	Steel
Is this safety railing coated?	Yes
Condition of coating	Decline/Thinning
Is this safety railing at least 42" to 43" in height?	Yes
What is the diameter of the tubing? (In Inches)	2
Does it span the circumference of the structure?	No
What is the approximate length of this railing? (In Inches)	400
Where is this safety railing located?	In front of north hatch and vent
Is this safety railing secure?	Yes
What is the overall condition of this safety railing?	Fair

Safety Railing Photos



INTERIOR

INTERIOR WALLS AESTHETICS

INTERIOR AESTHETICS NORTH WALL	
Is there Biofilm/Staining in this quadrant?	Yes
Severity of biofilm	Mild
Is this quadrant coated?	Yes
Condition of Protective Coating	Decline/Thinning

North Wall Aesthetics Photos




INTERIOR WALLS AESTHETICS	

Is there Biofilm/Staining in this quadrant?	Yes
Severity of biofilm	Mild
Is this quadrant coated?	Yes
Condition of Protective Coating	Decline/Thinning

South Wall Aesthetics Photos




INTERIOR WALLS AESTHETICS	

INTERIOR AESTHETICS EAST WALL	
Is there Biofilm/Staining in this quadrant?	Yes
Is this quadrant coated?	Yes
Condition of Protective Coating	Decline/Thinning

East Wall Aesthetics Photos




INTERIOR WALLS AESTHETICS

INTERIOR AESTHETICS WEST WALL	
Is there Biofilm/Staining in this quadrant?	Yes
Severity of biofilm	Mild
Is this quadrant coated?	Yes

West Wall Aesthetics Photos




INTERIOR WALLS STRUCTURAL

UPPER SECTION NORTH WALL	
Is there any sign of exposed steel in this section?	No
Is there any sign of corrosion in this section?	No
Is there any sign of pitting in this section?	No

MIDDLE SECTION NORTH WALL	
Is there any sign of exposed steel in this section?	No
Is there any sign of corrosion in this section?	No
Is there any sign of pitting in this section?	No

LOWER SECTION NORTH WALL	
Is there any sign of exposed steel in this section?	No
Is there any sign of corrosion in this section?	No
Is there any sign of pitting in this section?	No

Overall photo of entire quadrant

INTERIOR WALLS STRUCTURAL

UPPER SECTION SOUTH WALL	
Is there any sign of exposed steel in this section?	No
Is there any sign of corrosion in this section?	No
Is there any sign of pitting in this section?	No

MIDDLE SECTION SOUTH WALL	
Is there any sign of exposed steel in this section?	No
Is there any sign of corrosion in this section?	No
Is there any sign of pitting in this section?	No

LOWER SECTION SOUTH WALL	
Is there any sign of exposed steel in this section?	No
Is there any sign of corrosion in this section?	No
Is there any sign of pitting in this section?	No

Overall photo of entire quadrant

INTERIOR WALLS STRUCTURAL

UPPER SECTION EAST WALL	
Is there any sign of exposed steel in this section?	No
Is there any sign of corrosion in this section?	No
Is there any sign of pitting in this section?	No

MIDDLE SECTION EAST WALL	
Is there any sign of exposed steel in this section?	No
Is there any sign of corrosion in this section?	No
Is there any sign of pitting in this section?	No

LOWER SECTION EAST WALL	
Is there any sign of exposed steel in this section?	No
Is there any sign of corrosion in this section?	No
Is there any sign of pitting in this section?	No

Overall photo of entire quadrant

INTERIOR WALLS STRUCTURAL

UPPER SECTION WEST WALL	
Is there any sign of exposed steel in this section?	No
Is there any sign of corrosion in this section?	No
Is there any sign of pitting in this section?	No

MIDDLE SECTION WEST WALL	
Is there any sign of exposed steel in this section?	No
Is there any sign of corrosion in this section?	No
Is there any sign of pitting in this section?	No

LOWER SECTION WEST WALL	
Is there any sign of exposed steel in this section?	No
Is there any sign of corrosion in this section?	No
Is there any sign of pitting in this section?	No

Overall photo of entire quadrant

ICE CAP FORMATION

INTERIOR WALLS	
Is there any damage on the interior walls / coating that could be the result of ice cap formation? I.e., Ice scour	No

INTERIOR WALL WELDS

UPPER SECTION NORTH WALL	
Do all the welds in this section appear to be sound, free of fatigue /failure?	Yes
Does there appear to be any sign of leakage?	No

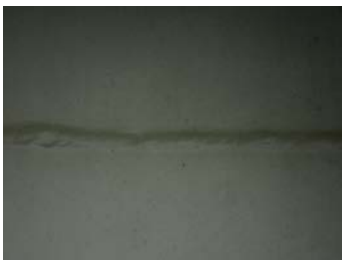
Upper North Wall Section- Photo of welds

MIDDLE SECTION NORTH WALL	
Do all the welds in this section appear to be sound, free of fatigue /failure?	Yes
Does there appear to be any sign of leakage?	No

Middle North Wall Section- Photo of welds

LOWER SECTION NORTH WALL	
Do all the welds in this section appear to be sound, free of fatigue /failure?	Yes
Does there appear to be any sign of leakage?	No

Lower North Wall Section- Photo of welds



UPPER SECTION SOUTH WALL	
Do all the welds in this section appear to be sound, free of fatigue /failure?	Yes
Does there appear to be any sign of leakage?	No

Upper South Wall Section- Photo of welds

MIDDLE SECTION SOUTH WALL	
Do all the welds in this section appear to be sound, free of fatigue /failure?	Yes
Does there appear to be any sign of leakage?	No

Middle South Wall Section- Photo of welds

LOWER SECTION SOUTH WALL	
Do all the welds in this section appear to be sound, free of fatigue /failure?	Yes
Does there appear to be any sign of leakage?	No

Lower South Wall Section- Photo of welds

UPPER SECTION EAST WALL	
Do all the welds in this section appear to be sound, free of fatigue /failure?	Yes
Does there appear to be any sign of leakage?	No

Upper East Wall Section- Photo of welds

MIDDLE SECTION EAST WALL	
Do all the welds in this section appear to be sound, free of fatigue /failure?	Yes
Does there appear to be any sign of leakage?	No

Middle East Wall Section- Photo of welds

LOWER SECTION EAST WALL	
Do all the welds in this section appear to be sound, free of fatigue /failure?	Yes
Does there appear to be any sign of leakage?	No

Lower East Wall Section- Photo of welds

UPPER SECTION WEST WALL	
Do all the welds in this section appear to be sound, free of fatigue /failure?	Yes
Does there appear to be any sign of leakage?	No

Upper West Wall Section- Photo of welds

MIDDLE SECTION WEST WALL	
Do all the welds in this section appear to be sound, free of fatigue /failure?	Yes
Does there appear to be any sign of leakage?	No

Middle West Wall Section- Photo of welds

LOWER SECTION WEST WALL	
Do all the welds in this section appear to be sound, free of fatigue /failure?	Yes
Does there appear to be any sign of leakage?	No

Lower West Wall Section- Photo of welds

INTERIOR FLOOR NORTH QUADRANT AESTHETICS

INTERIOR AESTHETICS NORTH FLOOR	
Is there Biofilm/Staining in this quadrant?	Yes
Severity of biofilm/staining?	Moderate
Is this quadrant coated?	No

North Floor Aesthetics Photos




INTERIOR FLOOR SOUTH QUADRANT AESTHETICS

INTERIOR AESTHETICS SOUTH FLOOR	
Is there Biofilm/Staining in this quadrant?	Yes
Severity of biofilm/staining?	Moderate
Is this quadrant coated?	No

South Floor Aesthetics Photos




INTERIOR FLOOR EAST QUADRANT AESTHETICS

INTERIOR AESTHETICS EAST FLOOR	
Is there Biofilm/Staining in this quadrant?	Yes
Severity of biofilm/staining?	Moderate
Is this quadrant coated?	No

East Floor Aesthetic Photos




INTERIOR FLOOR WEST QUADRANT AESTHETICS

INTERIOR AESTHETICS WEST FLOOR	
Is there Biofilm/Staining in this quadrant?	Yes
Severity of biofilm/staining?	Moderate
Is this quadrant coated?	No

West Floor Aesthetic Photos




INTERIOR FLOOR NORTH QUADRANT STRUCTURAL

INTERIOR STRUCTURAL NORTH FLOOR	
Are there any signs of cracks?	No
Were any areas of spall evident?	No

INTERIOR FLOOR SOUTH QUADRANT STRUCTURAL

INTERIOR STRUCTURAL SOUTH FLOOR	
Are there any signs of cracks?	No
Were any areas of spall evident?	No

INTERIOR FLOOR EAST QUADRANT STRUCTURAL

INTERIOR STRUCTURAL EAST FLOOR	
Are there any signs of cracks?	No
Were any areas of spall evident?	No

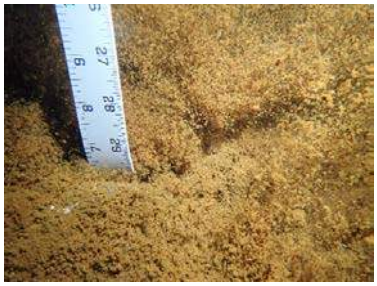
INTERIOR FLOOR WEST QUADRANT STRUCTURAL

INTERIOR STRUCTURAL WEST FLOOR	
Are there any signs of cracks?	No
Were any areas of spall evident?	No

CLEANING

SEDIMENT REMOVAL	
How much sediment was found on the bottom of this structure? (In Inches)	4.5 - 6.5
Sediment appears to be:	Brown sediment with white top layer
Was all sediment removed?	Yes

Before Sediment Removal



After Sediment Removal

Discharge Photo

INTERIOR COMPONENTS

INTERIOR MANWAY	
How many interior manways does this structure have?	2

INTERIOR MANWAY #1	
Location #1	East
Location #2	Wall
Shape	Circle
Diameter	24
Height above floor (in inches)	24
Is this manway secure?	Yes
Is there any sign of leakage?	No
Is this manway coated?	Yes
Condition of coating	Decline/Thinning
Is there any signs of metal exposure?	No
Is there any sign of corrosion?	No
Is there any sign of fatigue/pitting?	No
What is the condition of the gasket?	Good
Is there an access ladder for this manway?	No

Interior Manway Photos

INTERIOR MANWAY #2	
Location #1	West
Location #2	Wall
Shape	Circle
Diameter	24
Height above floor (in inches)	24
Is this manway secure?	Yes
Is there any sign of leakage?	No
Is this manway coated?	Yes
Condition of coating	Decline/Thinning
Is there any signs of metal exposure?	No
Is there any sign of corrosion?	No
Is there any sign of fatigue/pitting?	No
What is the condition of the gasket?	Good
Is there an access ladder for this manway?	No

Interior Manway #2 Photos

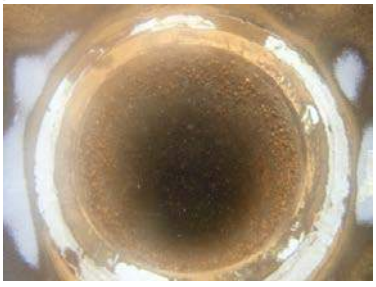
INTERIOR PIPING	
How many pipes does this structure have?	2

PIPE #1	
Where does this pipe penetrate the structure?	Floor
Does this pipe penetrate from a sump?	No
Does this pipe terminate within a sump?	No
What is the diameter of this pipe? (in inches)	12
What is the material of this pipe?	Steel
Is this pipe obstructed?	No
Is there anything on the end of this pipe?	Nothing
Was there flow at the time of inspection?	No
Is this pipe coated?	Yes
Condition of coating	Decline/Thinning
Is this pipe supported?	No

Pipe #1 Photos

PIPE #2	
Where does this pipe penetrate the structure?	Floor
Does this pipe penetrate from a sump?	No
Does this pipe terminate within a sump?	No
What is the diameter of this pipe? (in inches)	8
What is the material of this pipe?	Steel
Is this pipe obstructed?	No
Is there anything on the end of this pipe?	Nothing
Was there flow at the time of inspection?	No
Is this pipe coated?	Yes
Condition of coating	Decline/Thinning
Is this pipe supported?	No

Pipe #2 Photos



INTERIOR CATHODIC PROTECTION	
Does this structure have cathodic protection?	No

INTERIOR OVERFLOW	
Does this structure have an interior overflow?	Yes
How many overflows does this structure have?	1

OVERFLOW #1	
Location #1	East
Location #2	Wall
Is this overflow free of obstructions?	Yes
What is this overflow penetrating?	Wall
Where does this overflow terminate?	Wall
Is this overflow coated?	Yes
Condition of coating	Decline/Thinning
Is this overflow supported?	No

Overflow #1 Photo

INTERIOR LADDER

A. LADDER ACCESSIBILITY AND COMPLIANCE	
Does this structure have an interior ladder	No

INTERIOR OVERHEAD

INTERIOR OVERHEAD AESTHETICS

NORTH OVERHEAD AESTHETICS QUADRANT	
Aesthetic Deficiencies	Soiling
Is this quadrant coated?	Yes
Condition of Protective Coating	Decline/Thinning
Is the hatch visible in this quadrant?	Yes
Aesthetic Deficiencies	Good

North Overhead Aesthetics Photos


SOUTH OVERHEAD AESTHETICS QUADRANT	
Aesthetic Deficiencies	Soiling
Is this quadrant coated?	Yes
Condition of Protective Coating	Decline/Thinning
Is the hatch visible in this quadrant?	No

South Overhead Aesthetics Photos




EAST OVERHEAD AESTHETICS QUADRANT	
Aesthetic Deficiencies	Soiling
Is this quadrant coated?	Yes
Condition of Protective Coating	Decline/Thinning
Is the hatch visible in this quadrant?	No

East Overhead Aesthetics - Photos



WEST OVERHEAD AESTHETICS QUADRANT	
Aesthetic Deficiencies	Soiling
Is this quadrant coated?	Yes
Condition of Protective Coating	Decline/Thinning
Is the hatch visible in this quadrant?	Yes
Aesthetic Deficiencies	Good

West Overhead Aesthetics Photos




OVERHEAD STRUCTURAL

NORTH OVERHEAD STRUCTURAL QUADRANT	
Is there any sign of exposed steel?	No

Overall Photo of this quadrant

OVERHEAD STRUCTURAL

SOUTH OVERHEAD STRUCTURAL QUADRANT	
Is there any sign of exposed steel?	No

Overall Photo of this quadrant

OVERHEAD STRUCTURAL

EAST OVERHEAD STRUCTURAL QUADRANT	
Is there any sign of exposed steel?	No

Overall Photo of this quadrant

OVERHEAD STRUCTURAL

WEST OVERHEAD STRUCTURAL QUADRANT	
Is there any sign of exposed steel?	No

Overall Photo of this quadrant

INTERIOR BEAMS	
Does this structure have beams?	No

WATER QUALITY

WATER QUALITY	
Is there suspended particulate and/or color throughout the water column?	Yes
Water temperature at surface at time of inspection in fahrenheit.	52
Water temperature at bottom at time of inspection in fahrenheit.	51
Surface residual mg/L (total chlorine)	0
Is there a sample tap located at ground level?	No
Bottom residual mg/L (total chlorine)	.4
Water Quality - Additional Notes	No additional notes

INTERIOR MIXER

INTERIOR MIXER	
Does this structure have a mixer installed?	No

SITE SECURITY UPON COMPLETION

CLOSING FORM	
Was there a lock on the hatch upon your arrival?	Yes
Was hatch locked at the completion of services?	Yes
Did this structure have a locked access gate?	Yes
Was gate locked after completion of services?	Yes
Did you dive for the services completed today?	Yes

Photo of locked hatch after completion of services

Photo of locked gate after completion of services

MISCELLANEOUS FORM

MISCELLANEOUS FORM	
Work Performed	Exterior overflow screen replacement.

Photos

This report prepared by Underwater Solutions Inc. is based upon spot examination from readily accessible areas of the structure using visual and available non-destructive testing. Should latent defects or conditions which vary significantly from those described in this report be discovered at a later date, these conditions should be brought to the attention of Underwater Solutions Inc. or the structure manufacturer at that time. These comments should be viewed as information to be used by the Owner in determining the proper course of action and not to replace a complete set of specifications. All repairs should be done in accordance with A.W.W.A. and/or other applicable standards.

Underwater Solutions Inc.'s recommendations, remedial action and infrastructure asset management plan is being processed and will be uploaded into your platform within 45 days for your review.

Tighe&Bond

APPENDIX E

STATEWIDE AQUASTORE, Inc.
Premium Water and Wastewater Storage Tanks
Avetta
ISN

6010 Drott Drive
East Syracuse, NY 13057-2943
Phone: 315.433.AQUA (2782)
Fax: 315-433-5083
Website: www.besttank.com
Email: aquastore@besttank.com

July 18, 2022

Delaware Engineering
16 East Market Street
Red Hook, NY 12571
(518) 452-1790 Phone
(845) 399-4028 Cell

Attention: Ablen Amrod (aamrod@delawareengineering.com)

Re: **AQUASTORE®** Potable Water Ground Storage Tank
Red Hook, NY

Dear Ablen:

Thank you for your interest in **AQUASTORE®** glass-fused-to-steel storage tanks. The following budget price is for the Potable Water Storage Tank that you are interested in. The tank offered conforms to the manufacturing standards set forth by AWWA D103. Design is based on **AWWA D103/ASCE 7-16*** Category IV, 120 MPH wind and 40 PSF ground snow load. If the design parameters differ, the tank design and price may change accordingly.

- **Note: Foundation prices are ESTIMATES based on 4,000 PSF soil bearing capacity and Site Class C. Accurate soil bearing capacity, frost depth and any other pertinent information would be required to determine the exact design, type and cost of the foundation.**

Model	Nominal Capacity (Gallons)	Actual Capacity w/Freeboard	Freeboard (Inches) Provided	Diameter (Feet)	Height (Feet)	Tank Price Only *(No Foundation)*	TOTAL PRICE Tank *(with Foundation)*
39 101	910,400	892,400	24"	39.16'	101.04'	$1,500,000	$1,850,000

* ASCE 7-16 imposes restrictions on AWWA D103 and does not allow an embedded starter ring (Type 6 foundation) when the seismic overturning ratio exceeds 0.785. **A steel floor may be required to comply with ASCE 7-16.** The seismic overturning ratio is dependent on multiple variables including tank diameter, height, weight, seismic coefficients and site class. **The appropriate foundation type can be more accurately assessed upon receipt of a Geotechnical Report.**

NOT INCLUDED: *Any and all site work (ie: access roads, site preparation, excavation, backfill, pipe, etc.). Any permits, use taxes or bonds are not included. General Contractors' markup is not included.*

The following items are included in the budget numbers:

- **Cobalt Blue** Glass-Fused-To-Steel Shell Assembly with "**Edge Coating™**"
- Aluminum Geodesic Dome Roof Assembly with Gravity Vent and Safety Cable
- Concrete Floor, including Design
- OSHA Compliant Exterior Ladder, Cage, Platform Assembly and Lockable Ladder Device
- One (1) Standard Roof Manway and One (1) 30" Bottom Manway
- Aluminum Overflow Piping and Weir Box
- Exterior Protective Caps
- Sacrificial Anode Cathodic Protection System
- Tank Installation, Testing and Freight to Jobsite

continued on Page 2

July 18, 2022

Re: **AQUASTORE®** Potable Water Ground Storage Tank

Due to the current volatility of the steel market, the price in this quotation is valid for 30 days. Pricing is based on Open Shop, Prevailing wage labor. If you have any questions, please do not hesitate to call. We would be glad to provide you with job specific specifications and drawings for **AQUASTORE®** tanks as needed. Thank you for the opportunity to offer budget prices for your consideration. We look forward to working with you as this project develops.

Statewide Aquastore, Inc. is certified by the Women's Business Enterprise National Council (WBENC), New York State, Massachusetts, Pennsylvania, Connecticut and Vermont as a Women's Business Enterprise (WBE).

Respectfully,
Statewide Aquastore, Inc.

James McAloon
Eastern New York Regional Manager
(315) 433-2782 Phone
(315) 751-3937 Mobile
jamesm@besttank.com

cc: AMK; MPP; MP file 4476

STATEWIDE AQUASTORE, Inc.
Premium Water and Wastewater Storage Tanks
Avetta ISN

6010 Drott Drive
East Syracuse, NY 13057-2943
Phone: 315.433.AQUA (2782)
Fax: 315-433-5083
Website: www.besttank.com
Email: aquastore@besttank.com

August 18, 2022

Tighe & Bond
47 W. Market St.
Rhinebeck, NY 12572
(845) 516-5872 Phone

Attention: Daniel Valentine (dfvalentine@tighebond.com)

Re: **AQUASTORE®** Composite Elevated (CET) Potable Water Storage Tank
Red Hook, NY

Dear Daniel:

Thank you for your interest in **AQUASTORE®** glass-fused-to-steel composite elevated storage tanks. The following BALLPARK budget price is for the Composite Elevated Potable Water Storage Tank that you are interested in. The tank offered conforms to the manufacturing standards set forth by AWWA D103. Design is based on **NYSBC 2020 / IBC 18 / ASCE 7-16**, Category IV , 125 MPH wind and 35 PSF ground snow load. If the design parameters differ, the tank design and price may change accordingly.

- **Note: Foundation/Pedestal prices are ESTIMATES based on 4,000 PSF soil bearing capacity and Site Class D. Accurate soil bearing capacity, frost depth and any other pertinent information would be required to determine the exact design and costs of the foundation/pedestal.**

Model	Nominal Capacity in Gallons	Capacity w/Indicated Freeboard	Freeboard Inches Provided	Diameter in Feet	Sidewall Height in Feet	Overflow From Grade in Feet	Pedestal Diameter in Feet	Total Price
42 42	436,200	424,100	14.06”	41.96’	42.17’	98.00’	30.00’	$2,350,000

NOT INCLUDED: Any and all site work *(including but not limited to) access roads, site preparation, excavation, backfill, backfill materials, rock or organic material removal, compaction/compaction testing), all site pipe (material and installation). Also* ***NOT*** *included: Lightning protection, mixing systems, fencing, any electrical, name sheets and water/disposal for tank testing. Tank is not designed for additional loads from telecommunication companies.* ***Any permits, state or local sales, general contractors mark up and use taxes and bonds are not included.***

The following items are included in the budget numbers:

- **White** Glass-Fused-To-Steel Shell Assembly with “**Edge Coating™**”
- Aluminum Geodesic Dome Roof Assembly w/Gravity Vent, Walkway w/Single Handrail and Safety Cable
- Foundation, Pedestal (with Rustications) including Design (See Foundation Note)
- Glass-Fused-To-Steel Starter Ring Assembly embedded into the Concrete "Tank Support Slab"
- OSHA Compliant Ladder, Cage and Platform Assembly (ground level to top of tank)
- One (1) Standard Roof Manway and One (1) 30-inch Bottom Manway
- Aluminum Overflow Piping (to bottom of pedestal) and Weir Box
- Exterior Protective Caps
- Sacrificial Anode Cathodic Protection System
- Platform and Aluminum Railing
- Tank Installation, Testing and Freight

continued on Page 2

- Overhead Door in Base of Pedestal Column (10-ft wide x 10-ft high)
- Upper and Lower Standard Service Doors in Pedestal Column
- Single combination Inlet/Outlet Pipe (up to 12-inch diameter) inside Pedestal to 3-ft above the grade slab
- Insulation and Heat Trace of Inlet/Outlet Pipe Inside Pedestal
- Testing of Concrete and Piping (pipe test from top of pedestal to 3-ft above the grade slab)

Due to the current volatility of the steel market, the price in this quotation is valid for 30 days. Pricing is based on Open Shop, Prevailing wage labor. If you have any questions, please do not hesitate to call. We would be glad to provide you with job specific specifications and drawings for Aquastore® tanks if desired. We are looking forward to working with you as this project develops. Thank you again for the opportunity to offer budget prices for your consideration.

Respectfully,
Statewide Aquastore, Inc.

James McAloon
Eastern New York Regional Manager
(315) 433-2782 Phone
(315) 751-3937 Mobile
jamesm@besttank.com

cc: MPP; MT; EH; RV file

Tighe&Bond

APPENDIX F

Tighe&Bond

CONCEPTUAL OPINION OF PROBABLE CONSTRUCTION COST
Town of Red Hook - Water Distribution System
Existing 900,000 Gallon Welded Steel Standpipe Rehabilitation

SECTION	DESCRIPTION	UNITS	QTY	UNIT PRICE	TOTAL
Division 1 - General Conditions					
	General Conditions	LS	1	$145,000	$145,000
015136	Temporary Water	LS	1	$69,000	$69,000
Subtotal - Division 1					**$69,000**
Division 2 - Existing Conditions					
020000	Interior Sediment Cleanout	LS	1	$2,200	$2,200
Subtotal - Division 2					**$2,200**
Division 3 - Concrete					
033000	Tank Foundation - Concrete/Sealant/Caulking Repair	LS	1	$3,600	$3,600
Subtotal - Division 3					**$3,600**
Division 5 - Metals					
050500	Anchor Bolt Cleaning/Weld Nut-Baseplate-Bolt Connections	LS	1	$5,500	$5,500
050500	Galvanized Steel Bolts on Primary Shell Manway	LS	1	$600	$600
050500	Galvanized Steel Bolts on Secondary Shell Manway	LS	1	$600	$600
055133	Cable Type Safety Device on Exterior Access Ladder	LS	1	$4,300	$4,300
Subtotal - Division 5					**$11,000**
Division 7 - Thermal and Moisture Protection					
077233	30" Secondary Roof Manway	EA	1	$6,400	$6,400
Subtotal - Division 7					**$6,400**
Division 9 - Finishes					
090000	Exterior Spot Repair and Overcoat Painting	LS	1	$341,000	$341,000
090000	Interior Near White Blast to Steel and Painting	LS	1	$450,000	$450,000
Subtotal - Division 9					**$791,000**
Division 10 - Specialties					
102616	Cable Type Safety Device on Handrail	LS	1	$3,500	$3,500
Subtotal - Division 10					**$3,500**
Division 26 - Electrical					
260500	Tank Site Electrical	LS	1	$50,000	$50,000
Subtotal - Division 10					**$50,000**
Division 32 - Exterior Improvements					
329200	Loaming & Seeding	SF	500	$10	$5,000
Subtotal - Division 32					**$5,000**
Division 33 - Utilities					
331400	Frost Proof Drain Valve and Splash Pad	LS	1	$4,500	$4,500
331400	Overflow Pipe Flapper Valve and Screen	LS	1	$4,500	$4,500
Subtotal - Division 33					**$9,000**
Division 40 - Process Interconnections					
404642	Cathodic Protection System	LS	1	$20,000	$20,000
407000	Instrumentation - Tank Level/Antenna to Treatment Bldg.	LS	1	$30,000	$30,000
Subtotal - Division 40					**$50,000**
Division 46 - Water And Wastewater Equipment					
464100	Water Storage Tank Mixing System - Gridbee	LS	1	$33,000	$33,000
Subtotal - Division 46					**$33,000**
CONSTRUCTION SUBTOTAL (2022)					**$1,033,700**
Construction Cost Escalation to Midpoint of Construction (12%)					$124,000
CONSTRUCTION SUBTOTAL (2024)					**$1,157,700**
Contingency (20%)					$231,500
PROBABLE CONSTRUCTION COST					**$1,389,000**

Tighe&Bond

Town of Red Hook - Water Distribution System
Existing 900,000 Gallon Welded Steel Standpipe Rehabilitation

SECTION	DESCRIPTION	UNITS	QTY	UNIT PRICE	TOTAL

This is an engineer's Opinion of Probable Construction Cost (OPCC). Tighe & Bond has no control over the cost or availability of labor, equipment or materials, or over market conditions or the Contractor's method of pricing, and that the estimates of probable construction costs are made on the basis of Tighe & Bond's professional judgment and experience. Tighe & Bond makes no guarantee nor warranty, expressed or implied, that the bids or the negotiated cost of the Work will not vary from this estimate of the Probable Construction Cost.

Tighe&Bond

CONCEPTUAL OPINION OF PROBABLE CONSTRUCTION COST
Town of Red Hook - Water Distribution System
New 900,000 Gallon Glass-Fused-to-Steel Standpipe

SECTION	DESCRIPTION	UNITS	QTY	UNIT PRICE	TOTAL
Division 1 - General Conditions					
	General Conditions (beyond those incl. in 331613 tank price)	LS	1	$ 83,000	$ 83,000.00
015136	Temporary Water	LS	1	$ -	$ -
Subtotal - Division 1					**$ 83,000.00**
Division 2 - Existing Conditions					
024100	Selective Demolition	LS	1	$20,000	$20,000
024119	Existing Tank Demolition	LS	1	$175,000	$175,000
Subtotal - Division 2					**$195,000**
Division 3 - Concrete					
033000	Precast Catch Basin	EA	1	$5,800	$5,800
033000	Precast Concrete Valve Vault	LS	1	$115,000	$115,000
033000	Tank Foundation (included in 331613 tank price)	---	---	---	---
Subtotal - Division 3					**$120,800**
Division 26 - Electrical					
260500	Tank Site Electrical	LS	1	$50,000	$50,000
Subtotal - Division 26					**$50,000**
Division 31 - Earthwork					
312300	Compost Filter Tubes	LF	400	$11	$4,400
311000	Clearing and Grubbing	SY	800	$15	$12,000
312200	Grading	LS	1	$15,000	$15,000
312300	Tank Foundation Excavation & Backfill	CY	900	$35	$31,500
312343	Test Pit	CY	50	$30	$1,500
312300	Select Granular Fill	CY	50	$35	$1,750
Subtotal - Division 31					**$66,150**
Division 32 - Exterior Improvements					
323113	Chain Link Fence	LF	250	$90	$22,500
329200	Loaming & Seeding	SF	2,100	$10	$21,000
Subtotal - Division 32					**$21,000**
Division 33 - Utilities					
333113	12" Ductile Iron Pipe	LF	60	$250	$15,000
333113	6" Ductile Iron Pipe	LF	18	$150	$2,700
333113	12" Gate Valve	EA	5	$4,000	$20,000
333113	12" Check Valve	EA	2	$7,500	$15,000
333113	Disinfection	LS	1	$2,000	$2,000
333113	Testing of Water Distribution Systems	LS	1	$2,000	$2,000
331613	900,000 Glass-Fused-to-Steel Standpipe	LS	1	$1,850,000	$1,850,000
Subtotal - Division 33					**$1,906,700**
Division 40 - Process Interconnections					
407000	Instrumentation - Tank Level/Antenna to Treatment Bldg.	LS	1	$30,000	$30,000
Subtotal - Division 40					**$30,000**
Division 46 - Water And Wastewater Equipment					
464100	Water Storage Tank Mixing System - Gridbee	LS	1	$33,000	$33,000
Subtotal - Division 46					**$33,000**
CONSTRUCTION SUBTOTAL					**$2,505,700**
Construction Cost Escalation to Midpoint of Construction (12%)					$300,700
CONSTRUCTION SUBTOTAL (2024)					**$2,806,400**
Contingency (20%)					$561,300
PROBABLE CONSTRUCTION COST					**$3,368,000**

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Tighe&Bond

CONCEPTUAL OPINION OF PROBABLE CONSTRUCTION COST
Town of Red Hook - Water Distribution System
New 436,200 Gallon Glass-Fused-to-Steel Composite Elevated Tank

SECTION	DESCRIPTION	UNITS	QTY	UNIT PRICE	TOTAL
Division 1 - General Conditions					
	General Conditions	LS	1	$ 85,000	$ 85,000.00
015136	Temporary Water	LS	1	$ -	$ -
Subtotal - Division 1					**$ 85,000.00**
Division 2 - Existing Conditions					
024100	Selective Demolition	LS	1	$20,000	$20,000
024119	Existing Tank Demolition	LS	1	$175,000	$175,000
Subtotal - Division 2					**$195,000**
Division 3 - Concrete					
033000	Precast Catch Basin	EA	1	$5,800	$5,800
033000	Precast Concrete Valve Vault	LS	1	$115,000	$115,000
033000	Tank Foundation (included in 331613 tank price)	---	---	---	---
Subtotal - Division 3					**$120,800**
Division 26 - Electrical					
260500	Tank Site Electrical	LS	1	$50,000	$50,000
Subtotal - Division 26					**$50,000**
Division 31 - Earthwork					
312300	Compost Filter Tubes	LF	400	$11	$4,400
311000	Clearing and Grubbing	SY	800	$15	$12,000
312200	Grading	LS	1	$15,000	$15,000
312300	Tank Foundation Excavation & Backfill	CY	900	$35	$31,500
312343	Test Pit	CY	50	$30	$1,500
312300	Select Granular Fill	CY	50	$35	$1,750
Subtotal - Division 31					**$66,150**
Division 32 - Exterior Improvements					
323113	Chain Link Fence	LF	250	$90	$22,500
329200	Loaming & Seeding	SF	2,100	$10	$21,000
Subtotal - Division 32					**$21,000**
Division 33 - Utilities					
333113	12" Ductile Iron Pipe	LF	60	$250	$15,000
333113	6" Ductile Iron Pipe	LF	18	$150	$2,700
333113	12" Gate Valve	EA	5	$4,000	$20,000
333113	12" Check Valve	EA	2	$7,500	$15,000
333113	Disinfection	LS	1	$2,000	$2,000
333113	Testing of Water Distribution Systems	LS	1	$2,000	$2,000
333113	Separate Inlet/Outlet 12" Ductile Iron Pipe	LS	1	$15,000	$15,000
331613	436,200 Glass-Fused-to-Steel Composite Elevated Tank	LS	1	$2,350,000	$2,350,000
Subtotal - Division 33					**$2,421,700**
Division 40 - Process Interconnections					
407000	Instrumentation - Tank Level/Antenna to Treatment Bldg.	LS	1	$30,000	$30,000
Subtotal - Division 40					**$30,000**
Division 46 - Water And Wastewater Equipment					
464100	Water Storage Tank Mixing System - Gridbee	LS	1	$33,000	$33,000
Subtotal - Division 46					**$33,000**
CONSTRUCTION SUBTOTAL (2022)					**$3,022,700**
Construction Cost Escalation to Midpoint of Construction (12%)					$362,700
CONSTRUCTION SUBTOTAL (2024)					**$3,385,400**
Contingency (20%)					$677,100
PROBABLE CONSTRUCTION COST					**$4,063,000**

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APPENDIX G

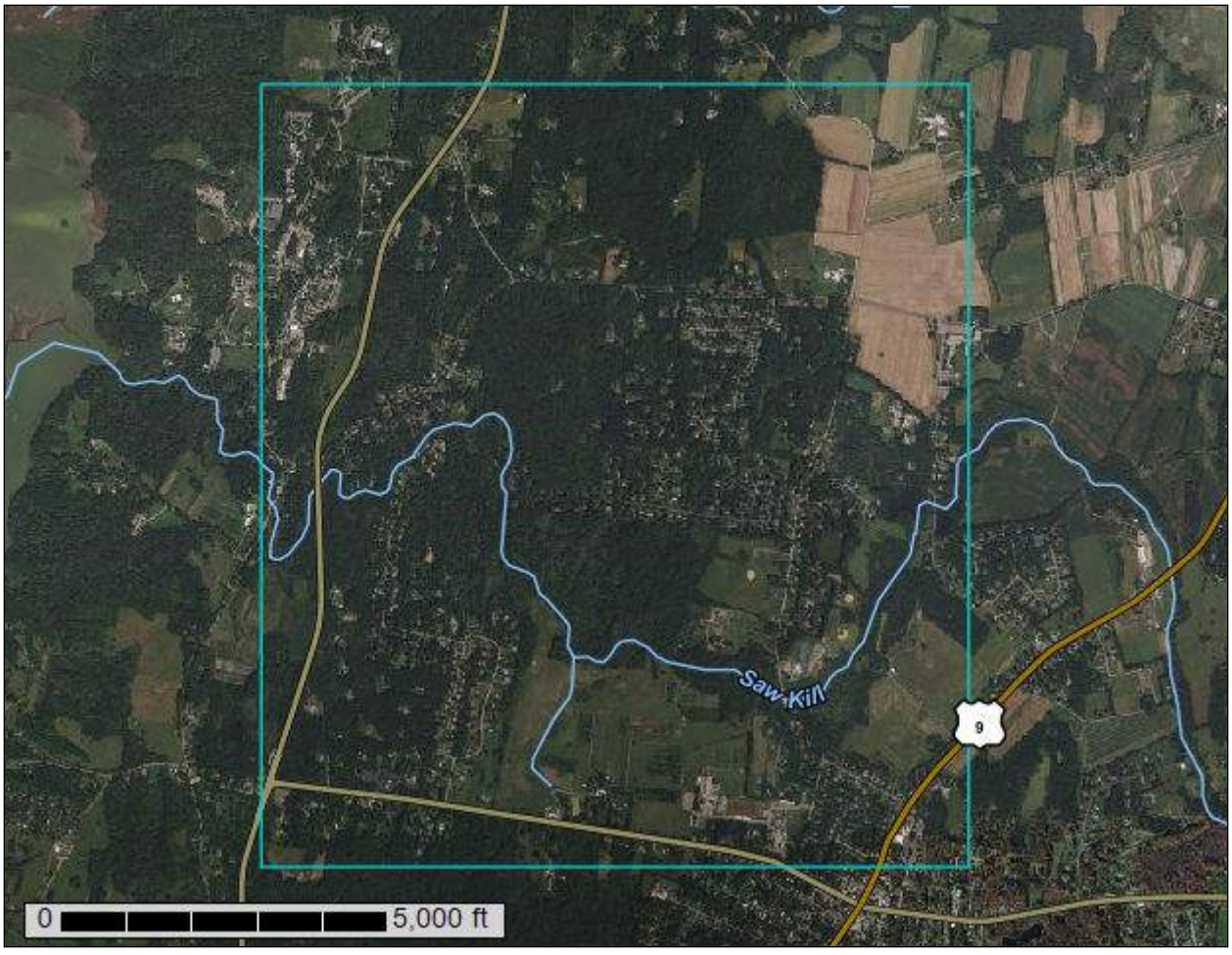
United States Department of Agriculture

NRCS

Natural Resources Conservation Service

A product of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local participants

Custom Soil Resource Report for Dutchess County, New York



August 19, 2022

Preface

Soil surveys contain information that affects land use planning in survey areas. They highlight soil limitations that affect various land uses and provide information about the properties of the soils in the survey areas. Soil surveys are designed for many different users, including farmers, ranchers, foresters, agronomists, urban planners, community officials, engineers, developers, builders, and home buyers. Also, conservationists, teachers, students, and specialists in recreation, waste disposal, and pollution control can use the surveys to help them understand, protect, or enhance the environment.

Various land use regulations of Federal, State, and local governments may impose special restrictions on land use or land treatment. Soil surveys identify soil properties that are used in making various land use or land treatment decisions. The information is intended to help the land users identify and reduce the effects of soil limitations on various land uses. The landowner or user is responsible for identifying and complying with existing laws and regulations.

Although soil survey information can be used for general farm, local, and wider area planning, onsite investigation is needed to supplement this information in some cases. Examples include soil quality assessments (http://www.nrcs.usda.gov/wps/portal/nrcs/main/soils/health/) and certain conservation and engineering applications. For more detailed information, contact your local USDA Service Center (https://offices.sc.egov.usda.gov/locator/app?agency=nrcs) or your NRCS State Soil Scientist (http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/contactus/?cid=nrcs142p2_053951).

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

The National Cooperative Soil Survey is a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local agencies. The Natural Resources Conservation Service (NRCS) has leadership for the Federal part of the National Cooperative Soil Survey.

Information about soils is updated periodically. Updated information is available through the NRCS Web Soil Survey, the site for official soil survey information.

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Contents

How Soil Surveys Are Made

Soil surveys are made to provide information about the soils and miscellaneous areas in a specific area. They include a description of the soils and miscellaneous areas and their location on the landscape and tables that show soil properties and limitations affecting various uses. Soil scientists observed the steepness, length, and shape of the slopes; the general pattern of drainage; the kinds of crops and native plants; and the kinds of bedrock. They observed and described many soil profiles. A soil profile is the sequence of natural layers, or horizons, in a soil. The profile extends from the surface down into the unconsolidated material in which the soil formed or from the surface down to bedrock. The unconsolidated material is devoid of roots and other living organisms and has not been changed by other biological activity.

Currently, soils are mapped according to the boundaries of major land resource areas (MLRAs). MLRAs are geographically associated land resource units that share common characteristics related to physiography, geology, climate, water resources, soils, biological resources, and land uses (USDA, 2006). Soil survey areas typically consist of parts of one or more MLRA.

The soils and miscellaneous areas in a survey area occur in an orderly pattern that is related to the geology, landforms, relief, climate, and natural vegetation of the area. Each kind of soil and miscellaneous area is associated with a particular kind of landform or with a segment of the landform. By observing the soils and miscellaneous areas in the survey area and relating their position to specific segments of the landform, a soil scientist develops a concept, or model, of how they were formed. Thus, during mapping, this model enables the soil scientist to predict with a considerable degree of accuracy the kind of soil or miscellaneous area at a specific location on the landscape.

Commonly, individual soils on the landscape merge into one another as their characteristics gradually change. To construct an accurate soil map, however, soil scientists must determine the boundaries between the soils. They can observe only a limited number of soil profiles. Nevertheless, these observations, supplemented by an understanding of the soil-vegetation-landscape relationship, are sufficient to verify predictions of the kinds of soil in an area and to determine the boundaries.

Soil scientists recorded the characteristics of the soil profiles that they studied. They noted soil color, texture, size and shape of soil aggregates, kind and amount of rock fragments, distribution of plant roots, reaction, and other features that enable them to identify soils. After describing the soils in the survey area and determining their properties, the soil scientists assigned the soils to taxonomic classes (units). Taxonomic classes are concepts. Each taxonomic class has a set of soil characteristics with precisely defined limits. The classes are used as a basis for comparison to classify soils systematically. Soil taxonomy, the system of taxonomic classification used in the United States, is based mainly on the kind and character of soil properties and the arrangement of horizons within the profile. After the soil

scientists classified and named the soils in the survey area, they compared the individual soils with similar soils in the same taxonomic class in other areas so that they could confirm data and assemble additional data based on experience and research.

The objective of soil mapping is not to delineate pure map unit components; the objective is to separate the landscape into landforms or landform segments that have similar use and management requirements. Each map unit is defined by a unique combination of soil components and/or miscellaneous areas in predictable proportions. Some components may be highly contrasting to the other components of the map unit. The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The delineation of such landforms and landform segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, onsite investigation is needed to define and locate the soils and miscellaneous areas.

Soil scientists make many field observations in the process of producing a soil map. The frequency of observation is dependent upon several factors, including scale of mapping, intensity of mapping, design of map units, complexity of the landscape, and experience of the soil scientist. Observations are made to test and refine the soil-landscape model and predictions and to verify the classification of the soils at specific locations. Once the soil-landscape model is refined, a significantly smaller number of measurements of individual soil properties are made and recorded. These measurements may include field measurements, such as those for color, depth to bedrock, and texture, and laboratory measurements, such as those for content of sand, silt, clay, salt, and other components. Properties of each soil typically vary from one point to another across the landscape.

Observations for map unit components are aggregated to develop ranges of characteristics for the components. The aggregated values are presented. Direct measurements do not exist for every property presented for every map unit component. Values for some properties are estimated from combinations of other properties.

While a soil survey is in progress, samples of some of the soils in the area generally are collected for laboratory analyses and for engineering tests. Soil scientists interpret the data from these analyses and tests as well as the field-observed characteristics and the soil properties to determine the expected behavior of the soils under different uses. Interpretations for all of the soils are field tested through observation of the soils in different uses and under different levels of management. Some interpretations are modified to fit local conditions, and some new interpretations are developed to meet local needs. Data are assembled from other sources, such as research information, production records, and field experience of specialists. For example, data on crop yields under defined levels of management are assembled from farm records and from field or plot experiments on the same kinds of soil.

Predictions about soil behavior are based not only on soil properties but also on such variables as climate and biological activity. Soil conditions are predictable over long periods of time, but they are not predictable from year to year. For example, soil scientists can predict with a fairly high degree of accuracy that a given soil will have a high water table within certain depths in most years, but they cannot predict that a high water table will always be at a specific level in the soil on a specific date.

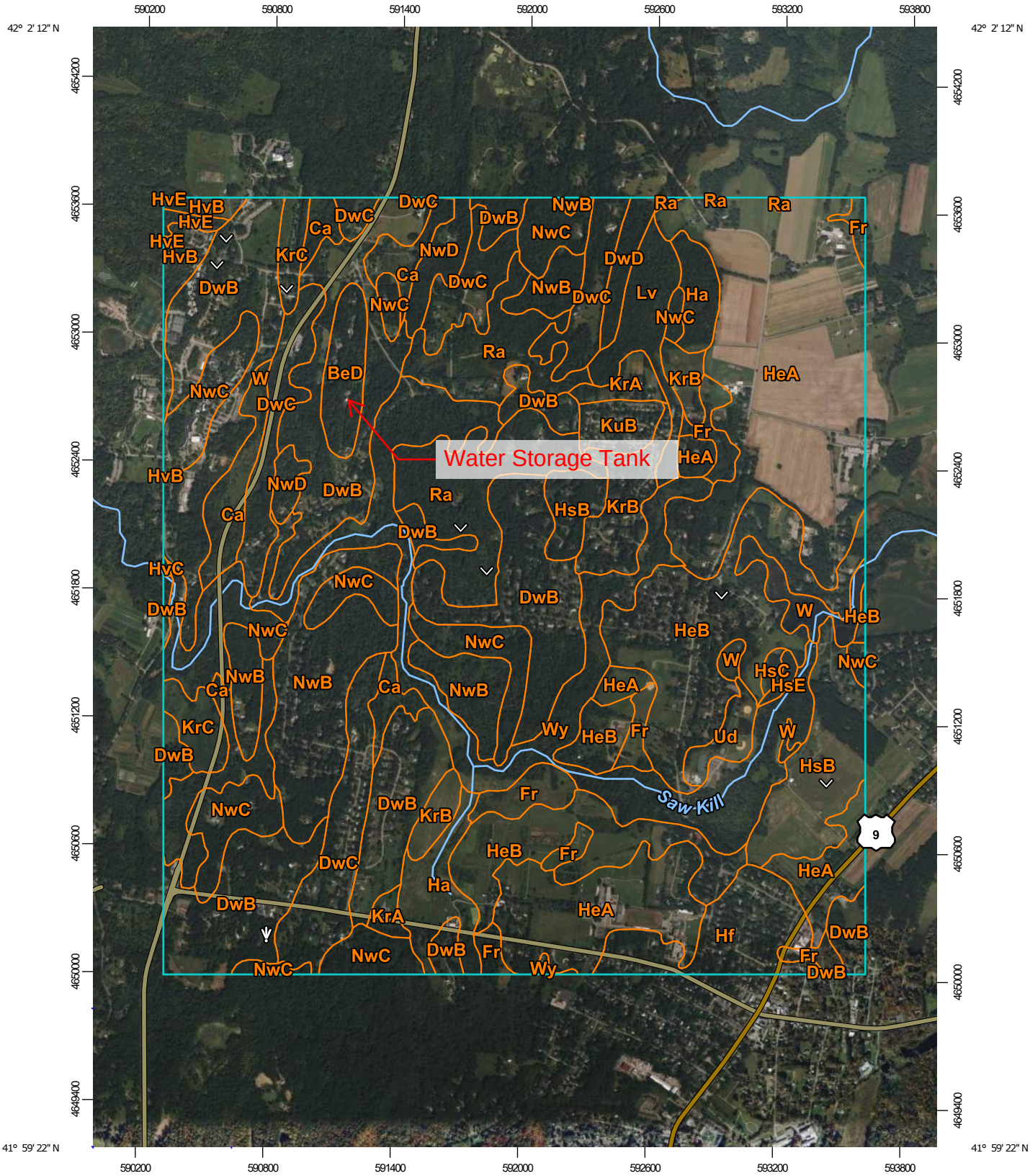
After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and

identified each as a specific map unit. Aerial photographs show trees, buildings, fields, roads, and rivers, all of which help in locating boundaries accurately.

Soil Map

The soil map section includes the soil map for the defined area of interest, a list of soil map units on the map and extent of each map unit, and cartographic symbols displayed on the map. Also presented are various metadata about data used to produce the map, and a description of each soil map unit.

Custom Soil Resource Report
Soil Map



Map Scale: 1:25,600 if printed on A portrait (8.5" x 11") sheet.

N

Meters: 0 350 700 1400 2100

Feet: 0 1000 2000 4000 6000

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 18N WGS84

MAP LEGEND

Area of Interest (AOI)

Area of Interest (AOI)

Soils

Soil Map Unit Polygons

Soil Map Unit Lines

Soil Map Unit Points

Special Point Features

Blowout

Borrow Pit

Clay Spot

Closed Depression

Gravel Pit

Gravelly Spot

Landfill

Lava Flow

Marsh or swamp

Mine or Quarry

Miscellaneous Water

Perennial Water

Rock Outcrop

Saline Spot

Sandy Spot

Severely Eroded Spot

Sinkhole

Slide or Slip

Sodic Spot

Spoil Area

Stony Spot

Very Stony Spot

Wet Spot

Other

Special Line Features

Water Features

Streams and Canals

Transportation

Rails

Interstate Highways

US Routes

Major Roads

Local Roads

Background

Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:24,000.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Dutchess County, New York
Survey Area Data: Version 18, Sep 1, 2021

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Aug 15, 2021—Nov 8, 2021

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
BeD	Bernardston silt loam, 15 to 25 percent slopes	32.2	1.1%
Ca	Canandaigua silt loam, neutral substratum	108.8	3.6%
DwB	Dutchess-Cardigan complex, undulating, rocky	536.1	17.9%
DwC	Dutchess-Cardigan complex, rolling, rocky	184.5	6.2%
DwD	Dutchess-Cardigan complex, hilly, rocky	17.3	0.6%
Fr	Fredon silt loam	64.5	2.2%
Ha	Halsey mucky silt loam	61.3	2.1%
HeA	Haven loam, nearly level	447.4	15.0%
HeB	Haven loam, undulating	268.7	9.0%
Hf	Haven-Urban land complex	71.7	2.4%
HsB	Hoosic gravelly loam, undulating	101.0	3.4%
HsC	Hoosic gravelly loam, rolling	3.9	0.1%
HsE	Hoosic gravelly loam, 25 to 45 percent slopes	4.0	0.1%
HvB	Hudson and Vergennes soils, 3 to 8 percent slopes	23.8	0.8%
HvC	Hudson and Vergennes soils, 8 to 15 percent slopes	0.6	0.0%
HvE	Hudson and Vergennes soils, steep	5.4	0.2%
KrA	Knickerbocker fine sandy loam, nearly level	20.9	0.7%
KrB	Knickerbocker fine sandy loam, undulating	66.3	2.2%
KrC	Knickerbocker fine sandy loam, rolling	35.0	1.2%
KuB	Knickerbocker-Urban land complex, undulating	21.2	0.7%
Lv	Livingston silt clay loam	45.1	1.5%
NwB	Nassau-Cardigan complex, undulating, very rocky	179.4	6.0%
NwC	Nassau-Cardigan complex, rolling, very rocky	215.9	7.2%
NwD	Nassau-Cardigan complex, hilly, very rocky	30.4	1.0%
Ra	Raynham silt loam	156.3	5.2%

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
Ud	Udorthents, smoothed	17.6	0.6%
W	Water	29.2	1.0%
Wy	Wayland silt loam	238.5	8.0%
Totals for Area of Interest		**2,987.0**	**100.0%**

Map Unit Descriptions

The map units delineated on the detailed soil maps in a soil survey represent the soils or miscellaneous areas in the survey area. The map unit descriptions, along with the maps, can be used to determine the composition and properties of a unit.

A map unit delineation on a soil map represents an area dominated by one or more major kinds of soil or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural phenomena, and they have the characteristic variability of all natural phenomena. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of other taxonomic classes. Consequently, every map unit is made up of the soils or miscellaneous areas for which it is named and some minor components that belong to taxonomic classes other than those of the major soils.

Most minor soils have properties similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting, or similar, components. They may or may not be mentioned in a particular map unit description. Other minor components, however, have properties and behavioral characteristics divergent enough to affect use or to require different management. These are called contrasting, or dissimilar, components. They generally are in small areas and could not be mapped separately because of the scale used. Some small areas of strongly contrasting soils or miscellaneous areas are identified by a special symbol on the maps. If included in the database for a given area, the contrasting minor components are identified in the map unit descriptions along with some characteristics of each. A few areas of minor components may not have been observed, and consequently they are not mentioned in the descriptions, especially where the pattern was so complex that it was impractical to make enough observations to identify all the soils and miscellaneous areas on the landscape.

The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate pure taxonomic classes but rather to separate the landscape into landforms or landform segments that have similar use and management requirements. The delineation of such segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, however, onsite investigation is needed to define and locate the soils and miscellaneous areas.

An identifying symbol precedes the map unit name in the map unit descriptions. Each description includes general facts about the unit and gives important soil properties and qualities.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer, slope, stoniness, salinity, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Alpha silt loam, 0 to 2 percent slopes, is a phase of the Alpha series.

Some map units are made up of two or more major soils or miscellaneous areas. These map units are complexes, associations, or undifferentiated groups.

A *complex* consists of two or more soils or miscellaneous areas in such an intricate pattern or in such small areas that they cannot be shown separately on the maps. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas. Alpha-Beta complex, 0 to 6 percent slopes, is an example.

An *association* is made up of two or more geographically associated soils or miscellaneous areas that are shown as one unit on the maps. Because of present or anticipated uses of the map units in the survey area, it was not considered practical or necessary to map the soils or miscellaneous areas separately. The pattern and relative proportion of the soils or miscellaneous areas are somewhat similar. Alpha-Beta association, 0 to 2 percent slopes, is an example.

An *undifferentiated group* is made up of two or more soils or miscellaneous areas that could be mapped individually but are mapped as one unit because similar interpretations can be made for use and management. The pattern and proportion of the soils or miscellaneous areas in a mapped area are not uniform. An area can be made up of only one of the major soils or miscellaneous areas, or it can be made up of all of them. Alpha and Beta soils, 0 to 2 percent slopes, is an example.

Some surveys include *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Rock outcrop is an example.

Dutchess County, New York

BeD—Bernardston silt loam, 15 to 25 percent slopes

Map Unit Setting

National map unit symbol: 9rdp
Elevation: 0 to 1,000 feet
Mean annual precipitation: 41 to 47 inches
Mean annual air temperature: 45 to 50 degrees F
Frost-free period: 115 to 195 days
Farmland classification: Not prime farmland

Map Unit Composition

Bernardston and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Bernardston

Setting

Landform: Till plains, hills, drumlinoid ridges
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Loamy, acid, dense till derived mainly from phyllite, shale, slate, and schist

Typical profile

H1 - 0 to 8 inches: silt loam
H2 - 8 to 27 inches: silt loam
H3 - 27 to 80 inches: silt loam

Properties and qualities

Slope: 15 to 25 percent
Depth to restrictive feature: 15 to 30 inches to densic material
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: About 18 to 24 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Low (about 4.8 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 4e
Hydrologic Soil Group: C/D
Ecological site: F144AY007CT - Well Drained Dense Till Uplands
Hydric soil rating: No

Minor Components

Pittstown

Percent of map unit: 5 percent
Hydric soil rating: No

Stockbridge
Percent of map unit: 5 percent
Hydric soil rating: No

Punsit
Percent of map unit: 2 percent
Hydric soil rating: No

Canandaigua
Percent of map unit: 1 percent
Landform: Depressions
Hydric soil rating: Yes

Sun
Percent of map unit: 1 percent
Landform: Depressions
Hydric soil rating: Yes

Unnamed soils, fine-loamy
Percent of map unit: 1 percent
Hydric soil rating: No

Ca—Canandaigua silt loam, neutral substratum

Map Unit Setting
National map unit symbol: 9rds
Elevation: 100 to 1,200 feet
Mean annual precipitation: 41 to 47 inches
Mean annual air temperature: 45 to 50 degrees F
Frost-free period: 115 to 195 days
Farmland classification: Farmland of statewide importance

Map Unit Composition
Canandaigua and similar soils: 80 percent
Minor components: 20 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Canandaigua

Setting
Landform: Depressions
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Tread
Down-slope shape: Concave
Across-slope shape: Concave
Parent material: Silty and clayey glaciolacustrine deposits

Typical profile
H1 - 0 to 6 inches: silt loam
H2 - 6 to 40 inches: silt loam
H3 - 40 to 72 inches: silt loam

Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Very poorly drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.57 in/hr)
Depth to water table: About 0 inches
Frequency of flooding: None
Frequency of ponding: Frequent
Calcium carbonate, maximum content: 1 percent
Available water supply, 0 to 60 inches: High (about 12.0 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 4w
Hydrologic Soil Group: C/D
Ecological site: F101XY010NY - Wet Lake Plain Depression
Hydric soil rating: Yes

Minor Components

Sun

Percent of map unit: 5 percent
Landform: Depressions
Hydric soil rating: Yes

Raynham

Percent of map unit: 5 percent
Landform: Depressions
Hydric soil rating: Yes

Livingston

Percent of map unit: 5 percent
Landform: Depressions
Hydric soil rating: Yes

Kingsbury

Percent of map unit: 3 percent
Hydric soil rating: No

Punsit

Percent of map unit: 2 percent
Hydric soil rating: No

DwB—Dutchess-Cardigan complex, undulating, rocky

Map Unit Setting

National map unit symbol: 9rfn
Elevation: 0 to 1,330 feet
Mean annual precipitation: 41 to 47 inches
Mean annual air temperature: 45 to 50 degrees F

Frost-free period: 115 to 195 days
Farmland classification: All areas are prime farmland

Map Unit Composition

Dutchess and similar soils: 40 percent
Cardigan and similar soils: 30 percent
Minor components: 30 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Dutchess

Setting

Landform: Ridges, hills
Landform position (two-dimensional): Summit
Landform position (three-dimensional): Crest
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Loamy till derived mainly from phyllite, slate, schist, and shale

Typical profile

H1 - 0 to 8 inches: silt loam
H2 - 8 to 28 inches: silt loam
H3 - 28 to 86 inches: channery silt loam

Properties and qualities

Slope: 1 to 6 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 1.98 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: High (about 9.6 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2e
Hydrologic Soil Group: B
Ecological site: F144AY034CT - Well Drained Till Uplands
Hydric soil rating: No

Description of Cardigan

Setting

Landform: Ridges, hills
Landform position (two-dimensional): Summit
Landform position (three-dimensional): Crest
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Loamy till or colluvium derived from phyllite, slate, shale, and schist

Typical profile

H1 - 0 to 8 inches: channery silt loam
H2 - 8 to 20 inches: channery loam
H3 - 20 to 30 inches: channery silt loam

H4 - 30 to 34 inches: unweathered bedrock

Properties and qualities

Slope: 1 to 6 percent
Depth to restrictive feature: 20 to 40 inches to lithic bedrock
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Low to moderately low (0.00 to 0.06 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Low (about 4.1 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2e
Hydrologic Soil Group: C
Ecological site: F144AY034CT - Well Drained Till Uplands
Hydric soil rating: No

Minor Components

Georgia

Percent of map unit: 10 percent
Hydric soil rating: No

Nassau

Percent of map unit: 9 percent
Hydric soil rating: No

Massena

Percent of map unit: 9 percent
Hydric soil rating: No

Sun

Percent of map unit: 1 percent
Landform: Depressions
Hydric soil rating: Yes

Rock outcrop

Percent of map unit: 1 percent
Hydric soil rating: Unranked

DwC—Dutchess-Cardigan complex, rolling, rocky

Map Unit Setting

National map unit symbol: 9rfp
Elevation: 0 to 1,330 feet
Mean annual precipitation: 41 to 47 inches
Mean annual air temperature: 45 to 50 degrees F
Frost-free period: 115 to 195 days

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APPENDIX H

CAPACITY DEVELOPMENT PROGRAM

TECHNICAL, MANAGERIAL, AND FINANCIAL EVALUATION CRITERIA FOR: COMMUNITY PUBLIC WATER SYSTEMS

SYSTEM NAME: Red Hook Water District No. 1

COUNTY: Dutchess **PWSID #:** 1302788

COMPLETED BY: Hank Van Parys, Chairman **DATE:** 8/25/2022

Technical Capacity

A. System Infrastructure

1. Does the system have as-built plans, drawings, or maps of its facilities including source, treatment, storage, and distribution?

☐ Yes ☐ No ☐ Not Applicable

If the system lacks certain plans, please specify:
Yes - for facilities built after district formation
No - for facilities built by previous owner (developer)

2. Does the system have exact location measurements of all main valves and service shut-offs?

☐ Yes ☒ No ☐ Not Applicable

3. Can the system's pumping, storage and distribution facilities meet current normal and peak demands and required distribution pressures?

☒ Yes ☐ No ☐ Not Applicable

4. Does the system have a water conservation plan?

☐ Yes ☒ No ☐ Not Applicable

5. Are all customers on the water system metered?

☒ Yes ☐ No ☐ Not Applicable

6. Is the system equipped with "master" meters that measure the amount of water the system produces or purchases for each source of water?

☒ Yes ☐ No ☐ Not Applicable

B. Source Water Evaluation

1. Does the system have a copy of its Source Water Assessment?

☒ Yes ☐ No ☐ Not Applicable

2. Has a yield analysis been done for the system's source?

☒ Yes ☐ No ☐ Not Applicable

3. Does the system have a description of the existing source-pumping capacity and the system's raw and finished water storage capacity?

☒ Yes ☐ No ☐ Not Applicable

4. For groundwater systems, does your system have a wellhead protection program in place?

☒ Yes ☐ No ☐ Not Applicable

C. Technical Knowledge

1. Has an evaluation of the water system facilities been conducted with respect to its ability to reliably meet current and proposed State and Federal drinking water regulations?

☒ Yes ☐ No ☐ Not Applicable

If system can't meet regulations, please specify:

_____

_____

2. Does the system have monthly water production records or treatment records that show daily and monthly water production for each source used by the system?

☒ Yes ☐ No ☐ Not Applicable

3. Has an evaluation been conducted to document the condition and remaining service life of existing facilities?

☒ Yes ☐ No ☐ Not Applicable

4. Has the system been cited within the past two years for failing to sample and report test results?

☐ Yes ☒ No ☐ Not Applicable

5. Has the system been cited within the past two years for operating deficiencies as a result of a sanitary survey or other inspection conducted by the DOH?

☐ Yes ☒ No ☐ Not Applicable

6. If you answered *"Yes"* to Questions 4 or 5, has corrective action been taken to correct all deficiencies?

☐ Yes ☐ No ☒ Not Applicable

D. Certified Operators

1. Does the water system have a certified water operator(s) and designated an operator in responsible charge?

☒ Yes ☐ No

2. If the water system does not have a state-certified water treatment operator, or lacks the necessary number of operators to safely and reliably operate the system, does the system have a plan to acquire the services of a (additional) state-certified operator?

☐ Yes ☐ No ☒ Not Applicable

Managerial Capacity

A. Staffing and Organization

1. What type of training/continuing education did system personnel attend within the last two years (please specify)?

Training is responsibility of our Contractor

2. Who is responsible for policy and operational decisions for the water system *(name and title)*?

Henry Van Parys, Chair Advisory Water Board

3. Who is responsible for ensuring compliance with state regulatory requirements *(name and title)*?

Fernando Pongo, Owner C3ND Environmental Consulting

4. Who is responsible for approving expenditures *(name and title)*?

Henry Van Parys, Chair Water Board
Town of Red Hook Town Board

5. *For systems that contract for system operation or management*: Does the system have a valid (signed) contract that summarizes the duties and responsibilities the contractor must provide to the system?

☒ Yes ☐ No ☐ Not Applicable

B. Ownership

1. *If the system is under temporary ownership*, has a future owner been found for the water system?

   ☐ Yes ☐ No ☒ Not Applicable

   If *"Yes"*, who will the future owner be?

   _____

2. *For systems that use, but do not own, land or facilities that are essential to water system operation:* Is there a valid long-term contract (i.e., lease) between the water system and the owner of the land or facilities essential to the operation of the system?

   ☐ Yes ☐ No ☒ Not Applicable

3. *For systems with a single proprietor:* Does the system have a contingency plan for continuing system operation in the event the owner becomes incapable of carrying out his/her responsibilities?

   ☐ Yes ☐ No ☒ Not Applicable

C. Consolidation/Restructuring

1. Has the system examined the feasibility of:
   a) Incorporating with an existing water system in the immediate proximity?

   ☐ Yes ☒ No ☐ Not Applicable

   b) Selling ownership to an existing water system?

   ☐ Yes ☒ No ☐ Not Applicable

   c) Contracting for the management or operation of the system with an existing system or satellite management/operations agency?

   ☐ Yes ☒ No ☐ Not Applicable

D. Emergency/Disaster Response Plans

1. Has the system developed an Emergency Response Plan?

   ☒ Yes ☐ No ☐ Not Applicable

2. Does the Emergency Response Plan:

   a) Designate responsible personnel in the event of an emergency?

   ☒ Yes ☐ No ☐ Not Applicable

b) Provide for emergency phone and radio capabilities?

☐ Yes ☐ No ☒ Not Applicable

c) Describe public and health department notification procedures?

☒ Yes ☐ No ☐ Not Applicable

3. Does the system have any emergency contract agreements under which it operates (e.g., emergency water interconnections and alternative sources)?

☒ Yes ☐ No ☐ Not Applicable

E. Water System Policies

1. Does the system have a *written* System Operations Manual or Policy?

☐ Yes ☒ No ☐ Not Applicable

F. Record Keeping

1. Does the system keep water utility records includirg: financial, regulatory, facility, operations and maintenance, data quality, Annual Water Quality Reports, and correspondence with the NYS Department of Health and/or local Health Departments (and where appropriate, the NYSPSC)?

☒ Yes ☐ No ☐ Not Applicable

Financial Capacity

A. Budget Projection – Revenues and Expenses

1. Does the system have a water budget?

☒ Yes ☐ No ☐ Not Applicable

2. Are the system's annual water revenues sufficient to cover the annual water expenses as well as anticipated capital improvements?

☒ Yes ☐ No ☐ Not Applicable

3. Are the system's water rates, when combined with other revenue sources, sufficient to cover all listed expenditures for the water system?

☒ Yes ☐ No ☐ Not Applicable

4. Does the system retain budget information for at least two years?

☒ Yes ☐ No ☐ Not Applicable

B. Reserves

1. Does the system have a reserve account (or funds within a reserve account) dedicated to:

   a) Financing the emergency replacement of critical facilities in the event of their failure?

   ☒ Yes ☐ No ☐ Not Applicable

   b) The maintenance of cash flow in the event of an unexpected funding shortfall?

   ☐ Yes ☒ No ☐ Not Applicable

2. If the system has a reserve account, how does it determine the amount to put into the account?

   ____ Fixed Amount ____ Percentage of Revenues ____ Percentage of Expenses

   X Other (please specify) Excess of revenue over expenses

3. If the system has a reserve account, what type(s) of reserve account(s) does it have?

   ____ Operation and Maintenance ___X___ Capital Projects ____ Debt Service

   ____ Other (please specify) _____

C. Capital Improvement Plan

1. How do you finance operation and maintenance costs (Check all that apply)?

X Rates collected from ratepayers	____ Rental fees
____ Other business revenue	____ Personal capital
____ Surcharges	____ Reserve account
____ Other (Please specify) _____	

2. How did you finance your LAST major repair or improvement?

____ Commercial bank loan	____ Bonds
____ DWSRF	____ Other State or federal loan/grant program
____ Surcharge	____ Personal Capital
X Reserve Account	____ Revenue from other business
____ Other (Please specify) _____	

3. What options do you have for financing your NEXT major repair or improvement?

____Commercial bank loan	__X__Bonds
__X__DWSRF	____Other State or federal loan/grant program
____Surcharge	____Personal Capital
__X__Reserve Account	____Revenue from other business
____Other (Please specify) _____	

D. Water System Rates

1. Does the water system management review user fee, user charge, or rate system at least once every two years?

☒ Yes ☐ No ☐ Not Applicable

2. What is the frequency of billing (e.g., 12, 6, or 4 times per/year)? 4 times/year

3. Where applicable, what are the system's water rates?

_____

4. What are rates based on?

____Capital Improvement Plan and Annual Budget
____Annual Budget Only
____Cash on Hand
____Last year's expenses
____Not sure
__X__Other (Please specify Rates Fixed by Town Board with 5% per year increase)

5. What was the date of the last rate increase? 10/1/21

END OF DOCUMENT

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